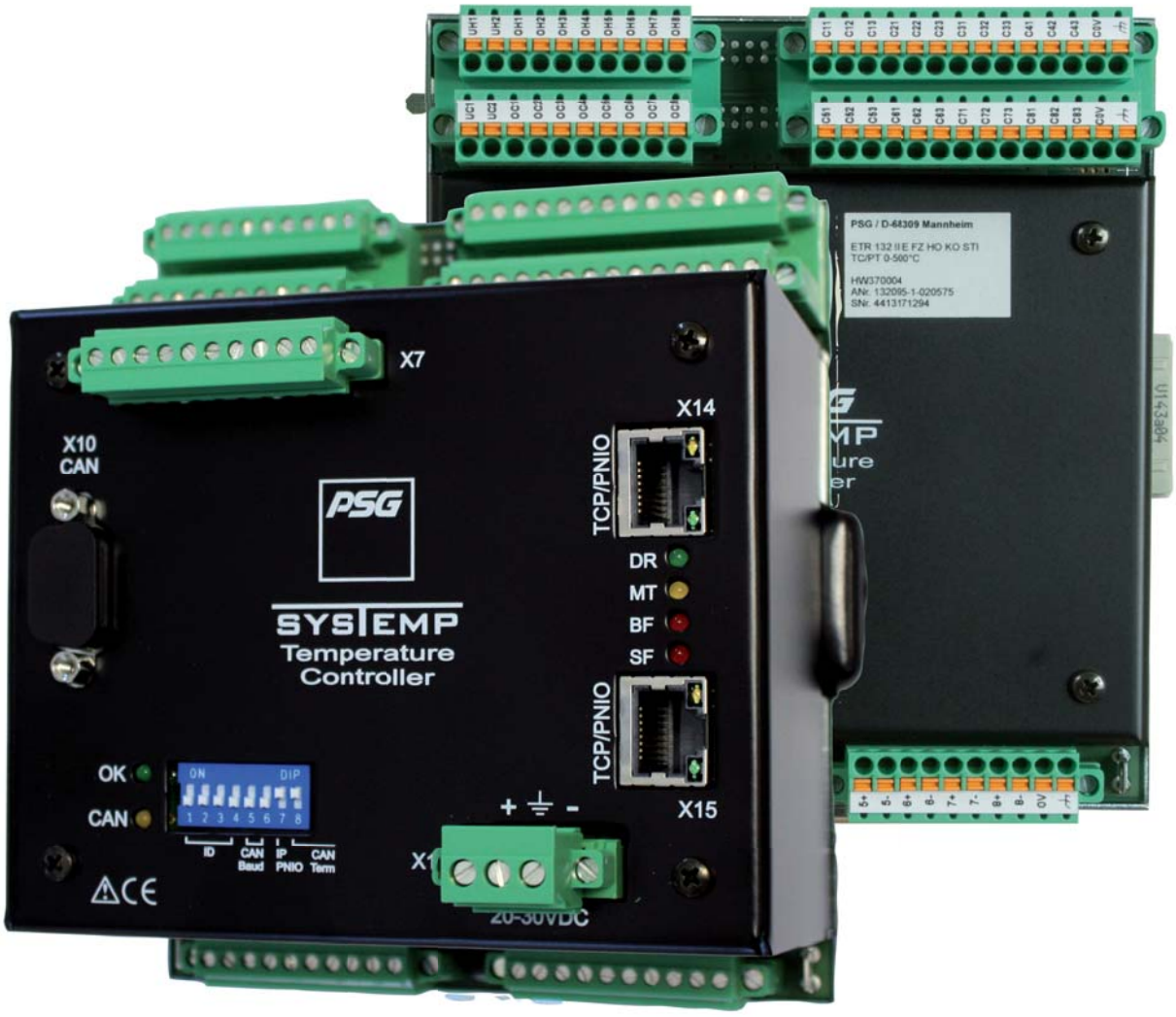
Plastic Service Group

Operating Instructions

ETR 132 PNIO



CE

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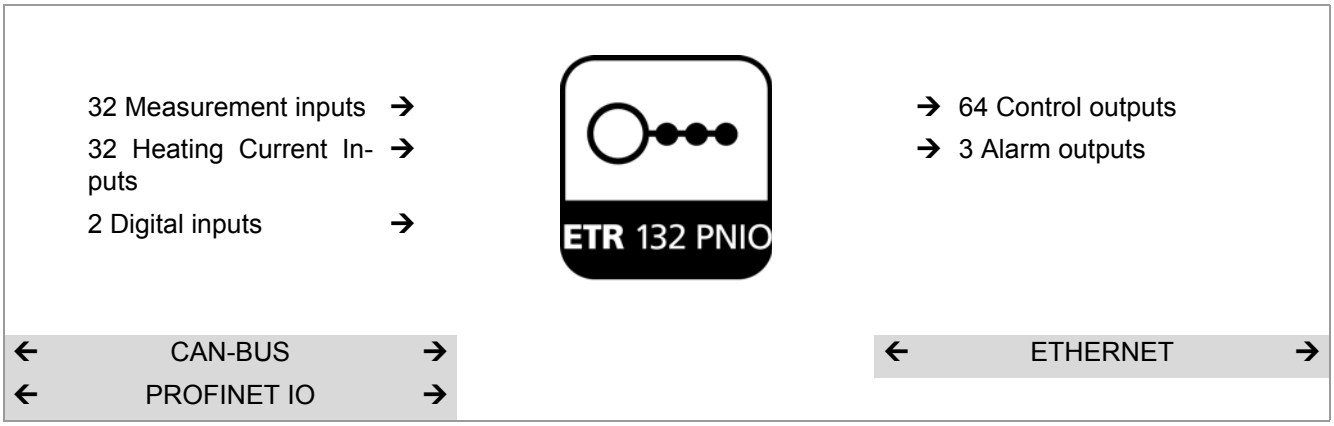
1 Introduction

Building on a common platform, the temperature control system sysTemp® PNIO offers different concepts for customized multi-zone temperature control.

The common platform of sysTemp® PNIO guarantees continuity with the configuration and parameterization, as well as with the connection over the available digital interfaces. On each controller the interfaces CAN bus, PROFINET IO and Ethernet are available.

The powerful and universal temperature controller **ETR132PNIO** is designed for employment in hot runner applications, machines for the plastics processing, packaging machines, furnaces, foodstuffs processing, dryers, etc. With its adaptive parameter matching, it can be used in a wide field of application from extremely fast to extremely slow zones.

The ETR132PNIO is modular built and consists of a basic module and up to three expansion modules for up to 32 three-position zones.



The device is available in different implementations. This must be considered at installation and operational startup. You find more detailed references to that in the chapter ↗Equipment Implementation and ↗Electrical connection and operational startup.

These directions assist, both in case of the initial installation and operational startup of the device, and in case of changes and adaptations to existing control systems. Status and error messages are described and remedies are recommended for elimination of faults.

The protocol descriptions for CAN-Bus, PROFINET IO and Ethernet are not a component part of the operating manual. You are provided with these on request or directly as a download from the home page of PSG Plastic Service GmbH (www.psg-online.de).

1.1 Typographical Conventions

Symbols and conventions are used in this manual for faster orientation for you.

Symbols

	Caution	With this symbol, references and information are displayed which are decisive for the operation of the device. In case of non-compliance with or inaccurate compliance there can result damage to the device or injuries to persons.
	Note	The symbol refers to additional information and declarations, which serve for improved understanding.
	Example	With the symbol, a function is explained by means of an example.
	Reference	With this symbol, information in another document is referred to.
↗		Cross references are marked with this character. In the pdf version of the document the objective of the cross reference is reached via the link.
`Equations`		Calculation specifications and examples are represented in this way.
n.a.		Not applicable, not existing

1.2 Additional and continuative documents

	Protocol PSG II Ethernet	Information on this topic are in the protocol description **PSG II Ethernet** and the corresponding object lists.
	Protocol PROFINET IO	Information on this topic are in the corresponding object lists **PROFINET IO**.
	Protocol CANopen	Information on this topic are in the protocol description **CANopen** and the corresponding object lists.
	Data sheets and operating manuals	Available by Internet see www.psg-online.de

Technical changes reserved

2 General Information

2.1 Warranty Conditions

This product is subject to the legal warranty time periods for faults or deficiencies in manufacture.

Content of Warranty

If a malfunction relatively occurs through the manufacture, PSG Plastic Service GmbH repairs or replaces the non-conforming product, according to their own discretion.

The following repairs do not fall under the warranty and are liable to costs:

- Malfunctions after the legal notice periods have expired.
- Malfunctions caused through operating error of the user (if the device is not operated as described in the manual).
- Malfunctions caused through other devices.
- Changes or damage to the device which do not originate from the manufacturer.

If you wish to use services within the framework of this guarantee, please refer to PSG Plastic Service GmbH.

2.2 Installation and safety references

Before installation, handling or operation of the device, please read through this operating instructions completely and carefully.

This device corresponds to the European Directives for Safety and EMC. It is within the sphere of responsibility of the commissioning engineer to keep to these directives during the installation of the device.

Standards

EN 61000-6-4, EN 61000-6-2, EN 61326-1

CE marking

The device complies with the European Directives for electromagnetic compatibility (complies with EN 61326-1).

Service and repair

This device is maintenance free.

If the device should indicate a fault, please contact the manufacturer. Customer repairs are not permissible.

Cleaning

Employ no water or cleaning agents based on water for the cleaning of the device stick-on labels. You can clean the surface of the devices with a mild soap solution.

Storage

If you should not put the device into operation immediately after unpacking, protect it against moisture and coarse dirt.

Personnel

The installation of the device may by carried out by qualified personnel only.

Wiring

The wiring system must be implemented correctly according to the specifications in this operating manual. All feeds and connecting terminals must be dimensioned for the corresponding amperage. Furthermore, all connections are to be carried out according to the valid VDE Specification and/or the respective national specifications.

Ensure in particular that the AC power supply is not connected with the logic output or the low-voltage input.

Overload protection

Secure the power supply of the device and the relay output with a fuse protection or a power circuit-breaker. This protects the printed circuit boards against overcurrent.

Environment

Conducting contamination must not reach the proximity of the device connecting terminals in the control cabinet. In order to achieve suitable ambient air conditions, install an air filter in the air inlet of the control cabinet. If the device should be in a condensing environment (low temperatures), install a thermostat-controlled heating unit in the control cabinet.

3 Equipment Implementation

3.1 Type designation

The equipment of the device, over and beyond the standard type, is stipulated with the order. The exact specification can be read off on the ↗Type plate type designation plate, which is on the carton, the casing and the printed circuit board.

The type designation identifies the equipment version and is composed of the options.

ETR132PNIO		
Module variant	G	Base module
Electrical connections	K FZ	Screw terminal Spring terminal
Control output	**HO**	Heating
Control output	- KO	Not existing Cooling
Measurement inputs	- TCPt U I	Not existing Thermocouple TC/ resistance thermometer Pt100 Standard signal U 0/2...10V Standard signal I 0/4...20mA
Heating current recording	- STI	Not existing Heating current recording
Data interface (only base module)	**CAN**	CAN-Bus with CANopen-conform connector pin assignment
Voltage	**24 V**	20...30 VDC

3.1.1 Type plate

The following information can be taken from the type plate:

PSG/D-68309 Mannheim ETR 132 PNIO K HO KO TC/PT CAN OPEN/Profinet/24VDC HW000000[2] SW80514[3] ANr. ******[4] SNr. **********[5]	**1** ↗Type designation **2** Revision identification of the printed circuit boards **3** Revision identification of the controller software **4** Order number **5** Serial number

To identify a device in a computer network clearly, a MAC address (Media Access Control address) will be given. The MAC addresses can be read on the label.

3.2 Scope of supply

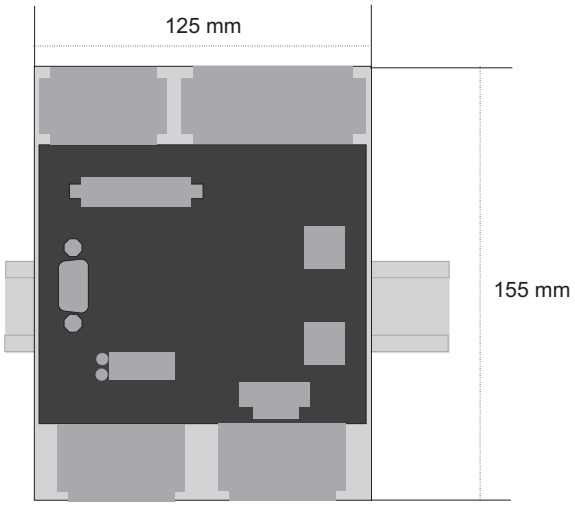
- 1 Temperature control system ETR132PNIO
- 1 CD-ROM with full documentation and software

3.3 Accessories

For information on the extensive accessories please refer to the homepage www.psg-online.de.

4 Device construction

4.1 Dimensions

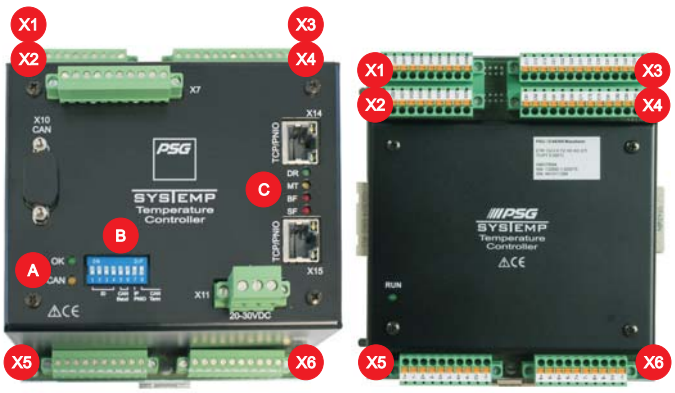


The modules ETR132PNIO G and ETR132 E have has a securing mechanism for the installation on DIN rail (DIN 50022) see ↗Installation/Dismantling.

The height and width specifications apply for both modules. ETR132 E is 30 mm deep.

4.2 Connection overview

The connection overview here indicates all possible connection variants.
The actual connection overview depends on the ↗Equipment Implementation which is stipulated with the order.



ETR132PNIO G and ETR132 E

X1	Control outputs heating 1...8
X2	Control outputs Cooling 1...8
X3/X4	Heating current monitoring 1...8
X5	Measurement inputs 1...4
X6	Measurement inputs 5...8
X7	Alarm outputs 1...3, Digital inputs 1...2
X10	CAN interface
X11	Power supply
X14	TCP/PNIO interface PROFINET IO
X15	TCP/PNIO interface PROFINET IO
A	Status-LED‘s
B	DIP switch
C	Status-LED‘s TCP/PNIO

4.2.1 Status LED‘s

The SIO-LED (yellow) signalizes the interface operation and flashes quicker or slower due to the amount of data.
In the normal case the OK-LED (green) on the front panel of the controller lights up permanently.

The OK-LED flashes if there is a fault. The cause of error can be read off on the basis of the number of flashing signals. Detailed information about the error cause can be referred to in the chapter ↗System errorand ↗Summary of system errors / flashing codes OK-LED

See also ↗Status indication TCP/PNIO LED‘s.

4.2.2 DIP switch

Detailed information on the function of the DIP switches are in the chapter ↗Addressing and Further Functions by DIP Switch

5 Installation/Dismantling

ESD Avoidance

To avoid ESD damages the device must be handled, packed, unpacked and stored in an especially protected environment (Electrostatic Protected Area, EPA). An ESD-protected work environment conducts existing electrostatic charges to ground in a controlled manner and prevents their re-occurrence.

Unpacking

The device is packed fully-mounted in a robust carton, cushioned with foamed material.

Check the packaging and then the device for identifiable damage incurred during transit. If damage is identified, then please get in touch with the transportation company.

In the case of damage the device may not be brought into operation.

Ensuring voltage-free state

Before beginning and during all installation/dismantling work, attention is to be paid that the system, as well as the devices, are de-energized

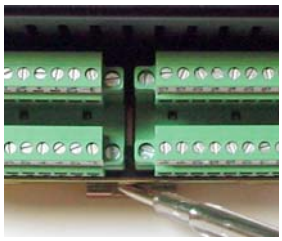
Installation location

A device of the protection type IP20 is to be installed in a closed control cabinet.

Securing

The device has a securing mechanism for installation on a DIN rail (DIN 50022).

Installation/Dismantling



The device is initially suspended in the DIN rail with the two straps (rear/middle side) and then latched in. For dismantling, the unlocking mechanism on the front below at the device (Illustration) is to be screwed down with a screwdriver and the device taken out towards the front/above.

Device exchange

Only controllers of the same type should be exchanged. In case of replacement, it is absolutely necessary to adopt the setting adjustments of the replaced controller.

6 Electrical connection and operational startup

The ETR132PNIO may be installed and put into operation by specialist personnel only.
Before switch-on of the control zones it is to be ensured that the ETR132PNIO is configured for the application. An incorrect configuration can lead to damage to the control section or to injuries to persons.

6.1 Connection type

In the standard type the device is equipped with screwed terminals. The terminals existing on the device are to be taken from the ↗Type designation
The following plugs of the Co. Phoenix are employed for the individual connections:

Connection ETR132PNIO	Type designation Plug for screwed terminal	Type designation OPTION Plug for spring terminal
X1...X2	MCVR 1.5/10-STF-3.81	FK-MCP 1.5/10-STF-3.81
X3...X4	MCVR 1.5/14-STF-3.81	FK-MCP 1.5/14-STF-3.81
X5...X6	MCVR 1.5/10-STF-3.81	FK-MCP 1.5/10-STF-3.81
X7	MCVR 1.5/10-STF-3.81	FK-MCP 1.5/10-STF-3.81
X11	MVSTBW 2.5 HC/3-STF-5.08	FKC 2.5 HC/3-STF-5.08

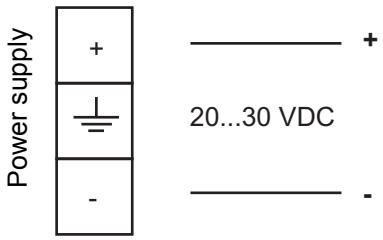
The wiring system is implemented on the screwed terminals and spring terminals with the appropriate cable lugs. Cables with a cross section of 0.5 to 1.5mm^2 can be employed.

6.2 Connector assignment and basic configuration

6.2.1 Power supply (Connection X11)

3 pole terminal

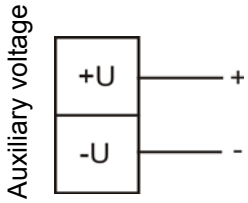
X11 DC voltage



Power consumption	Max. 25 VA on full load
Fuse	External device fuse protection 4 A time-delay (without load on X7/8)

6.2.2 Auxiliary voltage (Connection X7)

X7



For controller with 20...30 VDC power supply:
-0.7 V
Maximum output current: 1.5 A
Do not ground externally!

6.2.3 Measurement inputs (Connection X5 to X6)

The measurement inputs are stipulated in groups of eight (1...8 on basic module; 9...16, 17...24, 25...32 on expansion modules). The measurement inputs occupy 2 connections per input, 0V has to be used for all eight measurement inputs together.

10 pole terminal

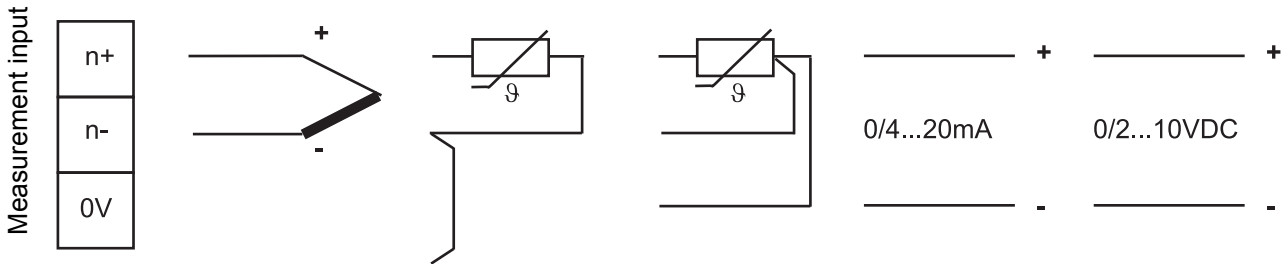
PIN	X5	X6
1	1+	5+
2	1-	5
3	2+	6+
4	2-	6-
5	3+	7+
6	3-	7-
7	4+	8+
8	4-	8-
9	0V*	0V*
10	⏚	⏚

Note *

Do not connect 0V (GND) system overall (over several controllers)!

Do not ground 0V (GND)-terminal externally!

X5 to **X6**	Thermocouple TC	Resistance thermometer Pt100 2-wire	Resistance thermometer Pt100 3-wire	Current I	Voltage U



The specifications apply for all measurement inputs.

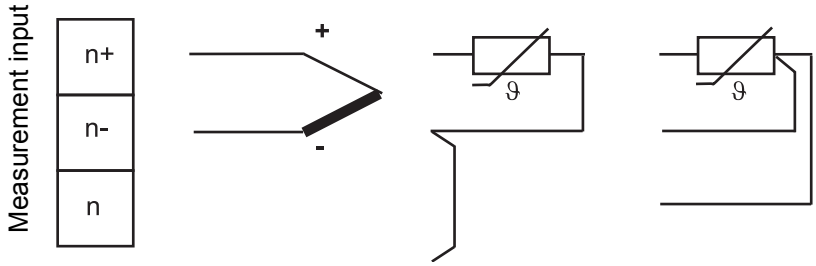
The the measurement inputs are to be indicated with the order. The possible combinations are to be taken from the ↗Type designation.

6.2.3.1 Measurement inputs of type designation TPDK

For devices with type designation TPDK (TC/Pt100, double level terminal) each measurement input has a separate HF ground and/or 0V terminal.

PIN	X5	X5	X6	X6
1	1+	1	5+	5
2	1-	⏚	5-	⏚
3	2+	2	6+	6
4	2-	⏚	6-	⏚
5	3+	3	7+	7
6	3-	⏚	7-	⏚
7	4+	4	8+	8
8	4-	⏚	8-	⏚
9	0V		0V	
10	⏚		⏚	

X5 to **X6**	Thermocouple TC	Resistance thermometer Pt100 2-wire	Resistance thermometer Pt100 3-wire



Configuration

Arrange sensor type for the measurement inputs.	↗[SP18] SEN1 - Sensor type Zone 1...8 ↗[SP19] SEN2 - Sensor type Zone 9...16 ↗[SP20] SEN3 - Sensor type Zone 17...24 ↗[SP21] SEN4 - Sensor type Zone 25...32
Stipulate offset valid for all zones.	↗[P033] OFFS - Temperature Offset
Stipulate offset valid for the corresponding zones.	↗[SP28] OFF1 - Offset Zone 1...8 ↗[SP29] OFF2 - Offset Zone 9...16 ↗[SP30] OFF3 - Offset Zone 17...24 ↗[SP31] OFF4 - Offset Zone 25...32
Stipulation of the measuring range, when measurement input is of the standard signal type.	↗[P047] RG L - Lower Temperature Value at Standard Signal Inputs ↗[P048] RG H - Upper Temperature Value with Standard Signal Inputs
Stipulate units of all measured values.	↗[SP22] CELS – Temperature Unit °C/°F
Specification of the measuring channel, if measured value comes from a FIN 08 or CANAIN08 over CAN-Bus.	↗[P057] NoZN - Zone Allocation to Measurement Input on Sensor Interface FIN

Technical changes reserved

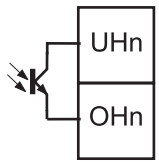
6.2.4 Control Outputs (Connection X1, X2)

The device is designed with 8 control outputs Heating (X1) and 8 control outputs Cooling (X2).
The number of 3- and 2-point zones is defined by the system setting.
10 pole terminal

PIN	X1	X2
1	UH1	UC1
2	UH2	UC2
3	OH1	OC1
4	OH2	OC2
5	OH3	OC3
6	OH4	OC4
7	OH5	OC5
8	OH6	OC6
9	OH7	OC7
10	OH8	OC8

X1

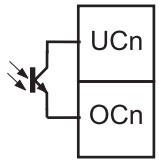
Control output H



UH1 power supply -0.7 V from X7/8 or U_{ext} or auxiliary terminal UH2/UC2 of other module.

X2

Control output K



UH1 power supply -0.7 V from X7/8 or U_{ext} or auxiliary terminal UH2/UC2 of other module.

Auxiliary voltage U- from connection X7/9 or $0V_{ext}$.

UH2/UC2 auxiliary terminal has the same electric potential like UH1/UC1 and can be used for the power supply of further outputs on other modules.

The specifications apply for all control outputs Heating/ Cooling.

Rated voltage	30VDC
Rated output current	60mA
	Inductive load only with external free-wheeling diode switchable

Configuration

Define the operating mode of the control zone.	↗[P038] COOL - 3-Point Operation
Stipulates the manner in which the actuating signal is output at the control output.	↗[P039] RELH – Heating Relay Output ↗[P040] RELC – Cooling Relay Output
Is the cooling output used as alarm output, stipulate which alarm is output on the cooling output.	↗[P043] ALC1 - Cooling Alarm Output 1 ↗[P044] ALC2 - Cooling Alarm Output 2

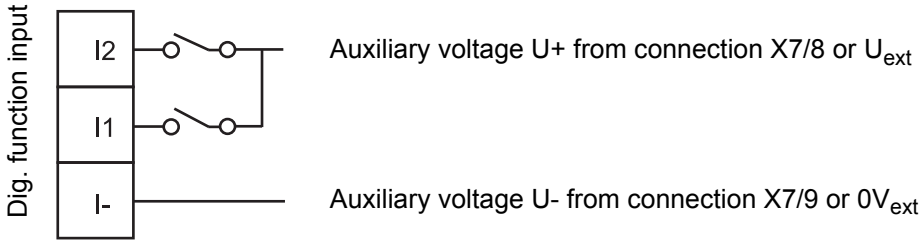
6.2.5 Digital inputs (Connection X7)

The digital inputs are realized with optocouplers. The standard device is designed with 2 digital function inputs (at Connection X7) .

The digital function inputs, as well as the digital inputs, work with functions fixed stored in the controller, which are defined by the system setting.

PIN	X7	Description
1	I2	Dig. function input 2
2	I1	Dig. function input 1
3	I-	Reference potential I *

X7



The specifications apply for all digital inputs.

Rated voltage	30VDC
Power requirement	approx. 12mA

Configuration

Stipulate function which is implemented on activation/deactivation of the two digital inputs on plug X7.	↗[SP23] INP1 - Function Digital Input 1 ↗[SP24] INP2 - Function Digital Input 2

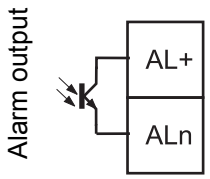
6.2.6 Digital outputs (Connection X7)

The digital outputs are realized with optocouplers. The standard device is designed with 3 alarm outputs (at connection X7) .

In the system setting it is defined which alarms are output on the outputs .

PIN	X7	Description
4	AL3	Alarm output 3
5	AL2	Alarm output 2
6	AL1	Alarm output 1
7	AL+	Supply voltage for alarm outputs

X7



Auxiliary voltage U+ from X7/8 or U_{ext}

Auxiliary voltage U- from connection X7/9 or $0V_{ext}$. The specifications apply for all digital outputs.

Rated voltage	30VDC
Rated output current	60mA
	Inductive load only with external free-wheeling diode switchable

Configuration

Stipulate function of the alarm output 1.	↗[SP08] A1D1 - Definition Byte 1 - Alarm Output 1 ↗[SP09] A1D2 - Definition Byte 2 - Alarm Output 1 ↗[SP10] A1D3 - Definition Byte 3 - Alarm Output 1
Stipulate function of the alarm output 2.	↗[SP11] A2D1 - Definition Byte 1 - Alarm Output 2 ↗[SP12] A2D2 - Definition Byte 2 - Alarm Output 2 ↗[SP13] A2D3 - Definition Byte 3 - Alarm Output 2
Stipulate function of the alarm output 3.	↗[SP14] A3D1 - Definition Byte 1 - Alarm Output 3 ↗[SP15] A3D2 - Definition Byte 2 - Alarm Output 3 ↗[SP15] A3D2 - Definition Byte 2 - Alarm Output 3
Stipulate which alarms are calculated if zone is passivated.	↗[P051] ALP1 - Alarm Calculation 1 with Passive Zones ↗[P052] ALP2 - Alarm Calculation 2 with Passive Zones

6.2.7 Heating Current Inputs (connection X3, X4)

The standard device is designed for registration of 3-phase heating currents per zone (individual current measurement) or summation current measurement.

In the system setting the measurement method is stipulated.

Use the current transformers available as accessories by PSG Plastic Service GmbH.

14 pole terminal

PIN	X3	X4
1	C11	C51
2	C12	C52
3	C13	C53
4	C21	C61
5	C22	C62
6	C23	C63
7	C31	C71
8	C32	C72
9	C33	C73
10	C41	C81
11	C42	C82
12	C43	C83
13	C0V*	C0V*
14	⏚	⏚

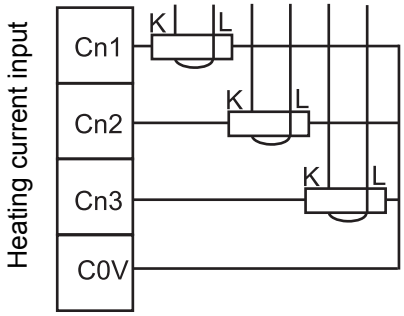
Individual current measurement

- the heating current inputs are tightly allocated to zones (C1* to zone 1, C2* to zone 2, etc.)
- for 1-phase current measurement do not connect the terminals for the second and third phase of one zone

Summation current measurement

- the heating current inputs are allocated to zones by ↗[P056] NoTR - Allocation Current Transformer

X3 and X4



Note *

Do not connect C0V system overall!

Do not ground C0V terminal!

Using the supply voltage measurement module SUW the system parameter SUW defines, on which current measurement input the SUW module is connected.

The specifications apply for all heating current inputs.

Input	Input voltage configurable (standard 42 mV/A)
Input resistance	20kOhm

Configuration

Specify method of measurement of heating current.	↗[SP25] AMPD – Heating Current Measurement Method
Comparative value for the heating current of the measured zone.	↗[P011] AMPN - Current Setpoint Value
Stipulate tolerance value for control of heating current value.	↗[P010] AMPT - Current Tolerance
Stipulate the measurement input where the current transformer of the controlled zone is connected to.	↗[P056] NoTR - Allocation Current Transformer
Stipulate the scale of the measurement input.	↗[Zone 046] AMPE - Current Range End Value
Stipulate the value of the heating current that rises an alarm in case of switched-off heating.	↗[SP34] AMPM - Maximum Current Value with Measurement Heater Off

6.2.8 CAN-Bus (Connection X10)

D-SUB, plug

PIN	X10 CANopen
1	n.a.
2	CAN-L
3	n.a.
4	n.a.
5	n.a.
6	n.a.
7	CAN-H
8	n.a.
9	n.a.

The communication over the CAN-Bus uses the protocol CANopen. You are provided with an object list (zone and system parameters which are stored for the controller type in the protocol) of the device, as a download, on request, or directly from the homepage PSG Plastic Service GmbH (www.psg-online.de).

Configuration

The configuration of the communication over the CAN-Bus interface is implemented with the aid of the parameters listed under ↗CAN-BUS.

6.2.9 TCP & PNIO interface (connection X14, X15)

RJ45, Socket

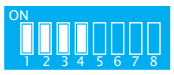
	PNIO PROFINET IO			TCP/IP	
PIN	**X14**	**X15**		**X14**	**X15**
1	TD+	TD+		Standard definition, automatic Cross-over	
2	TD-	TD-			
3	RD+	RD+			
4	Termination	Termination			
5	Termination	Termination			
6	RD-	RD-			
7	Termination	Termination			
8	Termination	Termination			

The communication over the PROFINET IO interface uses the protocol PROFINET IO. You are provided with an object list (zone and system parameters which are stored for the controller type in the protocol) of the device, as a download, on request, or directly from the homepage PSG Plastic Service GmbH (www.psg-onli-ne.de).

7 Addressing and Further Functions by DIP Switch

Using the DIP switch, the following configuration of the system and functions like acknowledgement can be carried out.

DIP 1...4



Device ID - NodeID/IP

Device ID is enciphered in binary form and is set adjusted over the DIP switches 1...4.
The device address is composed as follows for the individual interfaces:

CANBus Resulting NodeID = ↗[SP05] CADR - CANopen Base Address + Device ID

↗[SP05] CADR - CANopen Base Address = 32
Device ID = 2
Resulting NodeID = 34

Ethernet Resulting IP = ↗[SP46) IP1 - IP Address of 1. Octet.↗[SP47] IP2 - IP Address of 2. Octet.↗[SP48] IP3 - IP Address of 3. Octet.(↗[SP49] IP4 - IP Address of 4. Octet + Device ID)

↗[SP46) IP1 - IP Address of 1. Octet = 192
↗[SP47] IP2 - IP Address of 2. Octet = 168
↗[SP48] IP3 - IP Address of 3. Octet = 0
↗[SP49] IP4 - IP Address of 4. Octet = 200
Device ID = 2

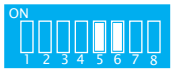
Resulting IP = 198.168.0.202

DIP 1...4 & DIP7

Device ID = DEFAULT

Resulting NodeID = 32
Resulting IP = 192.168.0.200
! Only if DIP7 = ON

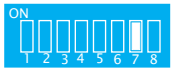
DIP 5...6



Baud rate CAN

DIP5	DIP6	Baud rate CAN
OFF	OFF	PSG (78.8 kBit)
ON	OFF	250 kBit
OFF	ON	500 kBit
ON	ON	125 kBit

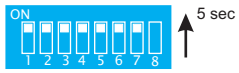
DIP7



IP dynamic/ fix

0 dynamic
The superior control system assigns an IP address to the device.
1 fix
The device uses the IP address set (see DIP 1...4).

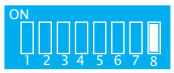
DIP 1...7



Take Over of Switch-On Configuration

On the base module DIP switch 1...7 must be set to ON for at least 5 seconds. This signalizes the system to take the new configuration, when the number of expansion units has changed.

DIP8



CANBus termination

DIP8 ON activates the internal CANBus termination impedance of 120 Ohm.

DIP 1...8

Acknowledge error report

By setting all 8 DIP switches to ON and thereafter to the pervious setting, the acknowledgement of pending error messages is initiated.

.

8 Status displays/Diagnostics

8.1 Information 'zone text'

In case of certain operational states of the controller, a text is overlaid alternately with the actual value in the zone display of the operating and display units. This text can be read out under the byte ZoneFMode for every zone over all interfaces. The information is also designated as a zone text.

Since only the zone text with the highest priority can always be displayed, the zone text is to be considered exclusively as an extension to the status information of a zone. The byte ZoneFMode includes the following information:

Bit	on	off
0...5	Zone text (↗Overview of zone texts)	
6	Zone has correct model of the zone. At least a ↗[P035] IDEN - Heating Identification has been successfully carried out.	Zone does not have any correct model of the zone. No ↗[P035] IDEN - Heating Identification has yet been successfully carried out.
7	Zone active.	Zone passive.

8.1.1 Overview of zone texts

Signal flag (dec)	Display	Meaning	Alarm	Status
1	Ma	Manual mode		x
2	CoU	Leading zone manual mode		x
3	AbS	Reduction		x
4	rAP	Temperature ramp		x
5	StA	Start-up operation		x
6		Without function		
7	Id	Identification		x
8	IdC	Cooling adaptation		x
9	tCb	Sensor break	x	
10	FAL	Sensor short-circuit	x	
11	tcP	Sensor incorrect polarity	x	
12	CAn	Fault in CAN communication	x	
13	Err	System error/ fault in channel data	x	
14	AL	Exceeded maximum temperature/ upper limit of measuring range	x	
15	PId	Plausibility violation during the identification		x
16	drI	Drift error report during identification phase		x
17	IF	Error report "No heating current measured" during identification phase	x	
18	SP2	2.setpoint value		x
19	SP3	3.setpoint value		x
20	SP4	4.setpoint value		x
21	dF1	Fault "No current" determined in case of "Heating current" diagnostics	x	
22	dF2	Fault "Current on incorrect zone" determined in case of "Heating current" diagnostics		x
23	dF3	Fault "Current both on correct as well as on another zone" determined with "Heating current" diagnostics		x
24	dE	No fault determined with "Heating current" diagnostics / "Allocation sensor/ heating" diagnostics ends		x
25	dIA	Diagnostics function active		x
26	dF4	Fault "Alarm current with switched off heating" determined in case of diagnostics		x
27	Ar	Automatic ramp		x
28	Ar.	Automatic ramp active, zone with least temperature rise		x
29	I -	Alarm "Current alarm with heating off"	x	
30	ALS	Storing alarm function	x	
31	IdS	Automatic cooling adaptation started, however still not active		x
32	GP	Zone waits for group release		x
33		n.a.		
34	000			
35	001	Error signal	x	
36	002	Module matching system error	x	
37	003	CPU calibration error	x	
38	004			

Technical changes reserved

Signal flag (dec)	Display	Meaning	Alarm	Status
39	005	Error in system data	x	
40	006			
41	007			
42	008	Switch-on configuration	x	
43	009	Switch-on configuration sensor	x	
44-49		n.a.		
50	Out	Power controller disconnected (Digital Input 2 active and system parameter INPD equal to 0 or 1)		x
51	CuI	CAN error in data link controller/CANSTI	x	
52	ArE	Automatic ramp fault	x	
53	ArE.	Automatic ramp fault, zone with least rate of rise	x	
54	GPO	Bypass group release		x
55	GPA	Reduce group release		x

8.2 System error

Unlike zone-specific faults (temperature limit values, heating current alarms, etc.) system errors identify faults on the controller itself. The system errors can be read out from the controller on the zone flags over all interfaces. Detailed information on this can be found in the object lists for the corresponding protocols.

The cause of error, the output of the OK-LED on the controller, the message text in the operating and display units, as well as notes on the elimination of the fault, are indicated below for all possible system errors.

Fault in the CPU basic matching

If the basic matching of the controller cannot be read correctly any longer, then the bit "Fault in the basic matching" is set.

- On all zones of the controller a degree of operation of 0% is output.
- On the OK-LED of the controller **a** flashing signal is output.
- With the operating and display units, ERR 003 is displayed.

For the removal of the fault, the controller is to be set to the ex-works state (Code Number 759). Before resetting into the ex-works state, please note down all channel data and system dates or read out and store with project setup and configuration tool.

Fault in the module matching

The module matching data items are stored on every module . If these cannot be read correctly any longer, then the bit "Fault in the module matching" is set.

- On all zones of the module, a degree of operation of 0% is output
- If a "fault in the module matching" is identified for the zones, then **two** flashing signals are output at the OK-LED of the controller.
- With the operating and display units, ERR 002 is displayed.

No possibility exists to eliminate the error report. The controller must be sent in for repair.

Fault in channel data

For the assurance of the data consistency and the data security, a checksum is stored for every zone in case of storage of the configuration data into the EEPROM.

The bit „Fault in channel data“ is activated, when the controller detects a check sum error during reading of channel data.

- If a "Fault in channel data" is identified, **seven** flashing signals are output on the OK-LED.
- With the operating and display units, ERR is displayed in the zone display.

For the removal of the fault, all zone-specific configuration parameters are to be checked, a value changed and the change stored in the EEPROM. After this, wait 20 seconds and carry out a controller reset. After the controller restart, the fault should have disappeared.

If the fault reappears after the reset, then there is a hardware fault in the EEPROM. The controller must be sent in for repair.

Fault in System data/ Attributes

The system data is stored grid-failure-secure in the EEPROM of the controller. The bit "Fault in system data/attributes" is set if data change without external intervention.

- On all zones of the controller a degree of operation of 0% is output.
- If a "Fault in system data/attributes" is identified, then **six** flashing signals are output on the OK-LED.
- With the operating and display units, ERR 005 is displayed.

For the removal of the fault, all system data and attributes are to be checked, a value changed and the changes taken over into the EEPROM. After this, wait 20 seconds and carry out a controller reset (e.g. over code number 999). After the controller restart, the fault should have disappeared.

If the fault reappears after the reset, then there is a hardware fault in the EEPROM. The controller must be sent in for repair.

CAN-Bus fault

A fault CAN-Bus occurs, for example, when data which should be received by the controller over CAN-Bus controller (e.g. measured values of FIN 08 or CANAIN 08) does not reach the controller or CAN components corresponding to the controller cannot be identified by the controller.

- In case of a fault on the CAN-Bus, **eight** flashing signals are output on the OK-LED.
- In case of the operating and display units, CAN is displayed in the zone displays.

For elimination of the fault all cable connections, settings of CAN baud rate, address settings have to be checked.

Error PROFINET-Chip (TPS1) not correctly started

If the PROFINETIO Chip does not start, a communication with the controller is not possible.

- If a "Fault PROFINET IO Chip" is identified, **nine** flashing signals are output on the OK-LED.

For elimination of the fault execute a controller reset. After the controller restart, the fault should have disappeared.

If the fault reappears after the reset, then there is a hardware fault in the EEPROM. The controller must be sent in for repair.

8.2.1 Summary of system errors / flashing codes OK-LED

Cause of error	Number of flashing signals	Display of operating and display units
Fault in the CPU basic matching	1	ERR 003
Fault in the module matching	2	ERR 002
Fault in System data/ Attributes	6	ERR 005
Fault sensor type (A sensor type is adjusted for the device, that is not supported by the device/calibration. The error report can be acknowledged (see ↗Addressing and Further Functions by DIP Switch). Check the setting of the sensor type after acknowledgement.		ERR 009
Error in channel data	7	ERR
CAN-Bus fault	8	CAN
Error PROFINET-Chip (not correctly started)	9	

8.3 Status indication TCP/PNIO LED‘s

LED	Status	Description
DR	**Device Ready**	
	OFF	PROFINET IO Interface not correctly started
	flashing	PROFINET IO Interface waits for synchronization with CPU (firmware start completed)
	ON	PROFINET IO Interface correctly started
MT	**Maintenance Required**	
BF	**Bus Failure**	
	ON	No Link-Status available
	flashing	Link-Status OK; no communication link to PROFINET IO controller
	OFF	PROFINET IO controller has an active communication link to PROFINET IO device
SF	**System Failure**	
	ON	PROFINET IO Diagnostics available
	OFF	No PROFINET IO Diagnostics

8.4 Diagnostic function (code number 600) - Allocation of Sensor and Heating

The controller has a complex automated function to check the allocation of sensors and Heating. The function checks, whether sensors and Heating are allocated and wired correctly.

The function uses the configuration parameter ↗[P032] STT4 - Start-up Time of 4. Set Point/4. Lowering Value. By this, a zone specific testing period is specified. The testing period defines the time, the zone should react on a trigger by the degree of operation.

For an optimal diagnostic process, the diagnostic function should be executed, when the zones are in cold condition.

- Specify a setpoint value for the zone that is smaller than the actual value
- Check the configuration parameter ↗[P032] STT4 - Start-up Time of 4. Set Point/4. Lowering Value
- Passive zones are not included in the diagnostics

The diagnostic function is basically executed until the end, even when errors are recognized. It is only interrupted, when a temperature rise for a degree of operation = 0% is detected, i.e. the actuator is defective, what can lead to an overheating of the zone.

The check routine is started by entry of code number 600 and runs in two phases.

Phase 1: Complete Check of all Zones together

In phase 1 the degree of operation

- of all active zones,
- whose setpoint value is greater than 0°C

is set to 0% and all actual value are monitored. Using the operating and display unit BA, in the zone display of the zones, relevant for diagnostic process, the message **dIA** is output. The zone display for the other zones is dimmed. The corresponding information can be requested by message flag ZoneFMode by interface.

Rises the actual value of any zone at least 5°C in between the testing period, in the zone display for this zone **dE** and **888** is displayed alternately and the check routine is completely stopped. The stopped check routine must be acknowledged by code number 602.

Phase 2: Single Check

After termination of phase 1 (takes as long, as the maximal specified value for ↗[P032] STT4 - Start-up Time of 4. Set Point/4. Lowering Value)

a single check of each zone, consecutive for each zone, is started.

For this, the degree of operation of one zone is set to 100% and monitored, whether a temperature rise of 5°C in between the specified testing period ↗[P032] STT4 - Start-up Time of 4. Set Point/4. Lowering Value is detected. Using the operating and display unit BA, in the zone display the message dIA is output.

After termination of the single check for all zones, the diagnostic result is immediately displayed in the zone display for the relevant zones. Alternately **dE** (DiagnosticResult) and a number are displayed, where the diagnostic result could easily be deduced.

Message BA at Diagnostic End		Meaning
dE	0	Zone OK
dE	1_32	The sensor to this zone is wrongly connected to channel x
dE	- 1_-32	The sensor to this zone is wrongly connected to channel x and with reversed polarity
dE	999	Sensor break
dE	888	Temperature rise in spite of degree of operation 0%
dE	≡ 777	No temperature rise during diagnostic period detected

The status of diagnostics of the zone can be requested by message flag ZoneFMode (for PSGII protocol offset 0x60).

Value of message flag ZoneFMode [1…5]	active = 25(dec)
Value of message flag ZoneFMode [1…5]	Diagnostics ended = 24 (dec)

(↗Information 'zone text')

When the diagnostics is terminated, the diagnostic result could additionally be requested by offset 0x6B (PSGII protocol), which has the same value like the message in the zone display of the operating an display unit BA.

After termination of the diagnostics the check routine must be acknowledged by code number 602. With the same code number the check routine can be stopped.

8.5 Diagnostic function (Code Number 601) - Start Current Measurement

After entry of the code number 601, a complex routine for an automated check of the allocation of "Heating/Current transformer" is started. The routine checks whether the feed lines for the Heating is led through the corresponding current transformer.

After start of the function, **dIA** is displayed in the zone displays, when the operating and display unit BA is used. The corresponding information can be requested by message flag ZoneFMode by interface.

The following messages could result out of the diagnostic function.

Message	Meaning
dF1	No current was detected
dF2	A current was detected on another zone
dF3	A current was detected on the right and on another zone
dF4	A current was measured, although no current should be detected
dE	Zone OK

8.6 Manual Activation of a Current Measurement (Code Number 41)

After entry of code number 41 in the process of cyclic current measurement (↗[SP25] AMPD – Heating Current Measurement Method <> 0) a current measurement is once triggered.

The current measurement is initiated by sending the code number 41. The code number is taken (ca. 1 second).

Wait for the end of the current measurement (at least 8 seconds), the alarm analysis follows. The cyclic current measurement runs afterwards normal.

9 Configuration and Settings

With the configuration parameters, zone (and/or channel) parameters and system parameters are distinguished between. Zone parameters are separately adjustable for every zone of the controller, while system parameters apply zone-independently for the entire controller.

Parameters are functionally collated in the description. The identification of a parameter is implemented over the following

- the **designation** of the configuration parameter as zone [P***] and/or system parameter [SP**],
- a **characteristic analog** for the identification of the parameter in the parameter lists of the project planning and configuration tool flexotempMANAGER
- the **parameter mnemonics** (English), which are employed for the identification in the operating and display units BA and in the project setup and configuration tool flexotempMANAGER (fM),
- the **parameter label**,
- the data type (Bit, Byte, Char, Word, Integer) and bytes occupied by the data type
- the setting range over the interfaces and over the operating and display units BA (if these are identical, the setting range is indicated only once) and a multiplication factor that is to be considered.
- a unit (when existent)

- The ex-works basic setting of a parameter is identified through a bracket (e.g. [on]).
- The handling of, as well as the access to, the parameters over the data interfaces (CAN-Bus, PROFINET IO, Ethernet) are to be taken from the protocol descriptions, as well as from the relevant parameter - / object lists.
- The maximum setting range of a parameter is stipulated through its data format. In general, the maximum possible setting range is functionally limited. This is indicated as a setting range for the interfaces.
- The detailed information on the data formats and ranges of values of the parameters are also to be found in the object lists to the interfaces.

9.1 Basic configuration

[P055] ZONE – Zone

Data type	Bit
Adjustment range interfaces	1, [0]
Adjustment range BA	off, [on]

For reasons of compatibility to PSG-controllers of older generations, the adjustment value is over interface in reverse logic.

1	off	■ At control output in accordance with operating mode (control/manual mode) actuating signals are output. ■ All alarms are calculated.
[0]	[on]	■ At control outputs no actuating signals are output. ■ Only those alarms are calculated which are released in the parameters ↗[P051] ALP1 - Alarm Calculation 1 with Passive Zones and ↗[P052] ALP2 - Alarm Calculation 2 with Passive Zones.

[P038] COOL - 3-Point Operation

Data type	Bit
Adjustment range interfaces	0, [1]
Adjustment range BA	off, [on]

0	off	The control algorithm works in two-point operation (heating). The output range of the degree of operation in control and manual mode is 0...100%. At the heating control output, actuating signals are output at positive setting levels, at the cooling output no actuating signal is output.
[1]	[on]	The control algorithm works in three-position operation (heating/cooling). The output range of the degree of operation in control and manual mode is -100...100%. On the heating control output, actuating signals are output at positive setting levels and, on the cooling output the actuating signals are output at negative setting levels.

[SP22] CELS – Temperature Unit °C/°F

Data type	Char
Adjustment range interfaces	0, [1]
Adjustment range BA	°F, [°C]

Unit of measurement signal.
The measured value is calculated directly in case of controllers with thermo-element and resistance thermometer inputs. In case of controllers with standard signal inputs, the calculation is implemented on the basis of the scaling parameters ↗[P047] RG L - Lower Temperature Value at Standard Signal Inputs and ↗[P048] RG H - Upper Temperature Value with Standard Signal Inputs

[SP38] MAXK – Maximum Number of Channels

Data type	Byte
Adjustment range interfaces/ multiplier	1...[32] / 1
Adjustment range BA	1...[32]

The parameter stipulates the zone number for which the regulation, as well as the alarm handling, is processed, starting from the first zone. The reduction of the zone number does not have any effect on the cycle duration in case of recording of the measured values.

9.2 Configuration inputs

[SP18] SEN1 - Sensor type Zone 1...8

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 / 1
Adjustment range BA	[FeL], FeJ, niC, Pt, Str, ni, nSi

The parameter stipulates the type of the sensors ([0 - L (Fe-L)], 1 - J (Fe-J), 2 - K (NiCr), 3 - PT100, 4 - Standard, 5 - NI100, 6 - N (NiCrSi)) which are connected to the measurement inputs of the corresponding zones.

- In case of controllers in the implementation TCPt, all eight measurement inputs can be switched over between thermo-element types (Fe CuNi L, Fe CuNi J, Ni CrNi K, NiCriSi NiSi N) and resistance thermometers (Pt100, Ni100).
- The measurement inputs of controllers in standard signal implementation U and I are not interchangeable. The sensor type is stipulated with ordering of the device and must be set adjusted according to the implementation.

[SP19] SEN2 - Sensor type Zone 9...16

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 / 1
Adjustment range BA	[FeL], FeJ, niC, Pt, Str, ni, nSi

↗[SP18] SEN1 - Sensor type Zone 1...8

[SP20] SEN3 - Sensor type Zone 17...24

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 / 1
Adjustment range BA	[FeL], FeJ, niC, Pt, Str, ni, nSi

↗[SP18] SEN1 - Sensor type Zone 1...8

[SP21] SEN4 - Sensor type Zone 25...32

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 / 1
Adjustment range BA	[FeL], FeJ, niC, Pt, Str, ni, nSi

↗[SP18] SEN1 - Sensor type Zone 1...8

[P033] OFFS - Temperature Offset

Data type	Char
Adjustment range interfaces & BA / multiplier	-9.9...[0.0]...9.9 unit of the measured value / 10

The measured value of *the* measurement input is corrected as follows:

```
Corrected measured value = measured value + temperature offset
```

[SP28] OFF1 - Offset Zone 1...8

Data type	Char
Adjustment range interfaces & BA / multiplier	-9.9...[0.0]...9.9 unit of the measured value / 10

For the measurement inputs of the zones 1 to 8 the following applies:

```
Corrected measured value = measured value + Offset Zone 1...8
```

[SP29] OFF2 - Offset Zone 9...16

Data type	Char
Adjustment range interfaces & BA / multiplier	-9.9...[0.0]...9.9 unit of the measured value / 10

For the measurement inputs of the zones 9 to 16 the following applies:

```
Corrected measured value = measured value + Offset Zone 9...16
```

[SP30] OFF3 - Offset Zone 17...24

Data type	Char
Adjustment range interfaces & BA / multiplier	-9.9...[0.0]...9.9 unit of the measured value / 10

For the measurement inputs of the zones 17 to 24 the following applies:

```
Corrected measured value = measured value + Offset Zone 17...24
```

[SP31] OFF4 - Offset Zone 25...32

Data type	Char
Adjustment range interfaces & BA / multiplier	-9.9...[0.0]...9.9 unit of the measured value / 10

For the measurement inputs of the zones 25 to 32 the following applies:

```
Corrected measured value = measured value + Offset Zone 25...32
```

[P047] RG L - Lower Temperature Value at Standard Signal Inputs

Data type	Word
Adjustment range interfaces/ multiplier	-99...[0]...6553.6 unit of the measured value / 10
Adjustment range BA	-99...[0]...999 unit of the measured value / 10

For a measurement input of type standard signal U or I direct on the controller, the parameter stipulates the value which is displayed in case of a measured value equal to 0/2 VDC and 0/4 mA.
Related with the parameter ↗[P048] RG H - Upper Temperature Value with Standard Signal Inputs a characteristic curve is defined, with its help the display values e.g for an input of 0...10V are calculated as follows:

```
Display value = 0.1 x (RG H - RG L) x Measured value + RG L
```

For measurement recording by CANAIN08/FIN08

- at APPL < 128 the actual value is not scaled
- at APPL >= 128 the display range of the actual value is defined by RG L and/or RG H

↗[P036] APPL - Application

Is a thermocouple TC and/or resistance thermometer Pt100 directly connected to the controller, the parameter is without function.

[P048] RG H - Upper Temperature Value with Standard Signal Inputs

Data type	Word
Adjustment range interfaces/ multiplier	-99...[1000]...6553.6 unit of the measured value / 10
Adjustment range BA	-99...[999] unit of the measured value

For a measurement input of type standard signal U or I direct on the controller, the parameter stipulates the value which is displayed in case of a measured value equal to 10 VDC and 20 mA.
↗[P047] RG L - Lower Temperature Value at Standard Signal Inputs

For measurement recording by CANAIN08/FIN08

- at APPL < 128 the actual value is not scaled
- at APPL >= 128 the display range of the actual value is defined by RG L and/or RG H

↗[P036] APPL - Application

Is a thermocouple TC and/or resistance thermometer Pt100 directly connected to the controller, the parameter is without function.

[P057] NoZN - Zone Allocation to Measurement Input on Sensor Interface FIN

Data type	Integer
Adjustment range interfaces & BA / multiplier	[-32]...255 / 1

0	The zone uses the measurement input assigned directly on the controller (Zone X - Measurement Input X)
>0	The zone uses the measurement input on a CANAIN08 or FIN08. Setting value dependent on address of the CANAIN08/FIN08: `Measurement input = (Address of the CANAIN08/FIN08 x 8) + (Measuring channel on CANAIN08/FIN08)` Zone 1 employs fifth measuring channel on a CANAIN08/FIN08 with address 2: Setting adjustment = (2 x 8) + 5 = 21 in case of Zone 1
<0	The zone uses the sensor input of another zone on the controller. Zone 1 uses measurement input of Zone 10: Adjustment = -10 in case of Zone 1

[SP23] INP1 - Function Digital Input 1

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

- For setting < 100 the parameter is compatible to parameter INPD of controllers sysTemp controllers and is valid for both digital inputs. ↗[SP24] INP2 - Function Digital Input 2 is without function.
- In case of setting values greater than 100, the parameter applies only for Digital Input 1. The function is stipulated which the controller implements with activated Digital Input 1.

	Digital Input 1	Digital Input 2	Digital Input 1 and 2
0	Regulation on 2. setpoint value	Heating actuator disconnected	Heating actuator disconnected
1	Relative reduction by 2. setpoint value	Heating actuator disconnected	Heating actuator disconnected
2	Regulation on 2. setpoint value	Regulation on 3. setpoint value	Regulation on 3. setpoint value
3	Relative reduction by 2. setpoint value	Relative reduction by 3. setpoint value	Relative reduction by 3. setpoint value
4	Regulation on 2. setpoint value	Regulation on 3. setpoint value	Regulation on 4. setpoint value
5	Relative reduction by 2. setpoint value	Relative reduction by 3. setpoint value	Relative reduction by 4. setpoint value
6	Regulation on 2. setpoint value	Reset-acknowledge stored alarms	Reset-acknowledge stored alarms
7	Relative reduction by 2. setpoint value	Reset-acknowledge stored alarms	Reset-acknowledge stored alarms
8	Regulation on 2. setpoint value	Start program function	Start program function
9	Relative reduction by 2. setpoint value	Start program function	Start program function
10	Regulation on 2. setpoint value	Regulation on 3. setpoint value	Regulation on 2. setpoint value
11	Relative reduction by 2. setpoint value	Relative reduction by 3. setpoint value	Relative reduction by 2. setpoint value
12	Regulation on 2. setpoint value (Zones 1-16)	Regulation on 2. setpoint value (Zones 17-32)	Regulation on 2. setpoint value (Zones 17-32)
13	Reduction relative by 2. setpoint value (Zones 1-16)	Reduction relative by 2. setpoint value (Zone 17-32)	Reduction relative by 2. setpoint value (Zone 17-32)
14	Regulation on 2. setpoint value	Regulation on 3. setpoint value	Regulation on 3. setpoint value
15	Relative reduction by 2. setpoint value	Relative reduction by 3. setpoint value	Start diagnostic function for sensor/heating
16	Relative reduction by 2. setpoint value	Setpoint value increase relative by 3. setpoint value	Setpoint value increase relative by 3. setpoint value
17	Relative reduction by 2. setpoint value	Setpoint value increase relative by 3. setpoint value	Start diagnostic function for sensor/heating
18	Relative reduction by 2. setpoint value	Time-controlled setpoint value increase relative by 3. setpoint value	Time-controlled setpoint value increase relative by 3. setpoint value
19	Percentage reduction/increase by 2. setpoint value	Percentage reduction/increase by 3. setpoint value	Percentage reduction/increase by 4. setpoint value
20	Regulation on 2. setpoint value	Disconnected heating actuator, signal low active	Disconnected heating actuator, signal low active
21	Relative reduction by 2. setpoint value	Disconnected heating actuator, signal low active	Disconnected heating actuator, signal low active
22	Regulation on 2. setpoint value	Regulation on 3. setpoint value	Passivate all zones
23	Relative reduction by 2. setpoint value	Relative reduction by 3. setpoint value	Passivate all zones

	Digital Input 1	Digital Input 2	Digital Input 1 and 2
24	Heating actuator disconnected (Zones 1-16), signal high active	Heating actuator disconnected (Zones 17-32), signal high active	Heating actuator disconnected (Zones 17-32), signal high active
25	Heating actuator disconnected (Zones 1-16), signal low active	Heating actuator disconnected (Zones 17-32), signal low active	Heating actuator disconnected (Zones 17-32), signal low active
26	Regulation on 2. setpoint value	Start program function	Passivate all zones
27	Relative reduction by 2. setpoint value	Start program function	Passivate all zones
28	Degree of operation boost (degree of operation = 100%) for 10 seconds	Activate BA input block	Activate BA input block
29	Reset-acknowledge stored alarms	Activate BA input block	Activate BA input block
30	Regulation on 2. setpoint value	Disconnected heating actuator, signal low active	Disconnected heating actuator, signal low active
31	Relative reduction by 2. setpoint value	Disconnected heating actuator, signal low active	Disconnected heating actuator, signal low active
32... 39	n.a.	n.a.	n.a.
40	Regulation on 2. setpoint value	Instant group release when 2. setpoint value < setpoint value.	Instant group release when 2. setpoint value < setpoint value.
41	Relative reduction by 2. setpoint value	Instant group release	Instant group release
42... 99	n.a.	n.a.	n.a.

100	Regulation on 2. setpoint value
101	Regulation on 3. setpoint value
102	Regulation on 4. setpoint value
103	Relative reduction by 2. setpoint value
104	Relative reduction by 3. setpoint value
105	Relative reduction by 4. setpoint value
106	Setpoint value increase relative by 2. setpoint value
107	Setpoint value increase relative by 3. setpoint value
108	Setpoint value increase relative by 4. setpoint value
109	Percentage reduction/increase by 2. setpoint value
110	Percentage reduction/increase by 3. setpoint value
111	Percentage reduction/increase by 4. setpoint value
112	Absolute reduction to 2. setpoint value, if 2. setpoint value < setpoint value
113	Absolute reduction to 3. setpoint value, if 3. setpoint value < setpoint value
114	Absolute reduction to 4. setpoint value, if 4. setpoint value < setpoint value
115	Disconnected heating actuator, signal active high
116	Disconnected heating actuator, signal low active
117	Heating actuator disconnected (Zones 1-16), signal high active
118	Heating actuator disconnected (Zones 1-16), signal low active
119	Heating actuator disconnected (Zones 17-32), signal high active
120	Heating actuator disconnected (Zones 17-32), signal low active

121	Passivate all zones
122	Activate BA input block
123	Reset-acknowledge stored alarms
124	Degree of operation boost (degree of operation = 100%) for 10 seconds
125... 199	n.a.
200	Start diagnostic function for sensor/heating (pushbutton)
201	Release all groups (group function) (pushbutton)
202	Start program function
203... 255	n.a.

[SP24] INP2 - Function Digital Input 2

Data type Byte

Adjustment range interfaces & BA / multiplier [0]...255 / 1

- In case of setting values of less than ↗[SP23] INP1 - Function Digital Input 1100, INP2 is without function.
- In case of setting values less than 100, no function is implemented.
- In case of setting values greater than 100, the parameter applies only for Digital Input 2. The function is stipulated which the controller implements with activated Digital Input 2.

100	Regulation on 2. setpoint value
101	Regulation on 3. setpoint value
102	Regulation on 4. setpoint value
103	Relative reduction by 2. setpoint value
104	Relative reduction by 3. setpoint value
105	Relative reduction by 4. setpoint value
106	Setpoint value increase relative by 2. setpoint value
107	Setpoint value increase relative by 3. setpoint value
108	Setpoint value increase relative by 4. setpoint value
109	Percentage reduction/increase by 2. setpoint value
110	Percentage reduction/increase by 3. setpoint value
111	Percentage reduction/increase by 4. setpoint value
112	Absolute reduction to 2. setpoint value, if 2. setpoint value < setpoint value
113	Absolute reduction to 3. setpoint value, if 3. setpoint value < setpoint value
114	Absolute reduction to 4. setpoint value, if 4. setpoint value < setpoint value
115	Disconnected heating actuator, signal active high
116	Disconnected heating actuator, signal low active
117	Heating actuator disconnected (Zones 1-16), signal high active
118	Heating actuator disconnected (Zones 1-16), signal low active
119	Heating actuator disconnected (Zones 17-32), signal high active
120	Heating actuator disconnected (Zones 17-32), signal low active
121	Passivate all zones
122	Activate BA input block
123	Reset-acknowledge stored alarms
124	Degree of operation boost (degree of operation = 100%) for 10 seconds

125... 199	n.a.
200	Start diagnostic function for sensor/heating (pushbutton)
201	Release all groups (group function) (pushbutton)
202	Start program function
203... 255	n.a.

9.3 Configuration/Functions Outputs

[P002] OPWR – Degree of Operation

Data type Char
Adjustment range interfaces & BA / multiplier -100...[0]...100% / 1

Actuating variable. Calculated in the standard operation through controllers. In the manual mode, the specification is implemented manually by the operator.
↗[P003] MANU – Manual Mode

[P039] RELH – Heating Relay Output

Data type Bit
Adjustment range interfaces [0], 1
Adjustment range BA [off], on

Specifies the manner in which the actuating signal is output at the Heating control output. Through this, an adaptation of the actuating signal to the actuator (SSR, relay) is possible.

0	off	Output of the actuating variable through fast clocked pulse groups (e.g. for the output to solid state relay). The minimum pulse width is 40 ms.
1	on	Per sampling cycle (corresponds to sampling time) the actuating variable is output in the block (one-time switching on and off of the setting output). The operating time is proportional to the degree of operation with reference to the sampling time. In order to take care of the actuator the ↗[P018] CT-H - Heating Sampling Time is set to a minimum of 10 seconds.

[P040] RELC – Cooling Relay Output

Data type Bit
Adjustment range interfaces 0, [1]
Adjustment range BA off, [on]

Stipulates the type of the output of the actuating signal at the cooling control output. Used for the adaptation of the actuating signal to the actuator (SSR, relay).

0	off	Output of the actuating variable through fast clocked pulse groups (e.g. for the output to solid state relay). The minimum pulse width is 40 ms.
1	on	Per sampling cycle (corresponds to sampling time) the actuating variable is output in the block (one-time switching on and off of the setting output). The operating time is proportional to the degree of operation with reference to the sampling time. The ↗[P022] CT-C - Cooling Sampling Time is limited to a minimum of 10 seconds.

[P023] OUTH – Heating Degree of Operation Damping

Data type Char
Adjustment range interfaces & BA / multiplier 0...[100]% / 1

Correction of the heating degree of operation:
`Corrected degree of operation = degree of operation x 0.01 x setting value`

Setting value OUTH = 75
Uncorrected degree of operation = 85%
Corrected degree of operation = 85% x 0.01 x 75 = 63% (rounded)

[P024] OUTC – Cooling Degree of Operation Damping

Data type	Char
Adjustment range interfaces & BA / multiplier	0...[100]% / 1

Correction of the degree of operation cooling:
`Corrected degree of operation = degree of operation x 0.01 x setting value`

Setting value OUTC = 75
Uncorrected degree of operation = -40%
Corrected degree of operation = -40% x 0.01 x 75 = -30%

[P025] OUT% – Maximum Degree of Operation in Manual Mode

Data type	Char
Adjustment range interfaces & BA / multiplier	0...[100]% / 1

Limitation of the maximum heating degree of operation in manual mode. Can be set e.g. as a safety function for the function ↗[P037] TC-A – Manual Mode after Sensor Break.

9.4 Basic Functions

[P003] MANU – Manual Mode

Data type	Bit
Adjustment range interfaces	[0], 1
Adjustment range BA	[off], on

[0]	[off]	Regulation active. Degree of operation is calculated from the control algorithm.
1	on	Regulation deactivated. Manual specification of the ↗[P002] OPWR – Degree of Operation. In manual mode, a zone, e.g. in case of a defect of the measuring means (e.g. sensor break with thermocouple) can be further operated in emergency operation. In manual mode the alarms are further monitored and the heating current monitoring also continues to function.

↗[P037] TC-A – Manual Mode after Sensor Break

[P028] STMO - Startup Operation

Data type	Bit
Adjustment range interfaces	[0], 1
Adjustment range BA	[off], on

Function for temperature control field of application of hot conduit systems for the dehydrating of heating elements after start of temperature control.
If, after a reset of the controller

- in case of an active zone
- whose setpoint value is greater than 100°C

a temperature actual value is identified less than 90°C, the time set adjusted under ↗[P029] STT - Startup Operation Initiation Time is controlled to 100°C. The time starts when the actual values of all zones of the controller,

with which the startup operation is activated, have been one-time in the tolerance band of the startup setpoint value of 100°C.
In case of networking of several controllers over CAN, the function works with controller-overall effect.

[P029] STT - Startup Operation Initiation Time

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 minutes / 1
Adjustment range BA	[0]...99 minutes

↗[P028] STMO - Startup Operation

[P054] NoCO - Leading Zone

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

Function used to control the zone with the output value of another zone. It is used e.g. in case of defect of the error sensing device corresponding to the zone (e.g. sensor break). In order to maintain the operation of the control zone in spite of that, the zone in the leading zone operation is operated with the degree of operation of a similar zone.

[0]	Leading zone operation deactivated. Zone employs its own degree of operation calculated through the regulation or specified manually.
>0	The zone employs the degree of operation of the zone specified in the setting value. Since the function works with controller-overall effect (Prerequisite: Controller connected over CAN) the controller address is a component part of the setting value: `Leading zone NoCO = (DIP switch setting x 32) + zone number` In the case of a zone with defective sensor, the degree of operation of the fifth zone of the controller should be employed as leading zone, with which the addressing DIP Switches 1 and 2 are set to on (corresponds to Address 3): NoCO = (3 x 32) + 5 = 101 The output value output is completely synchronous, if ■ the zone is located on the same controller ■ the ↗[P053] K-CO – Amplification Factor for Zone in Leading Mode is set equal to 0 If both conditions are not fulfilled, an asynchronous output value signal is then implemented. A cascading of the leading zone is not permissible. In case of invalid inputs (when e.g. a zone is entered as a leading zone which itself has a reference to a leading zone), the setting value is set automatically to 0.

[P053] K-CO – Amplification Factor for Zone in Leading Mode

Data type	Char
Adjustment range interfaces/ multiplier	-128...[0]...128 / 1
Adjustment range BA	-99...[0]...100

Enables the adaptation of the output value of the leading zone for the zone led.
`Adapted degree of operation = Degree of operation * (1 + (0.01 x K-CO))`

The degree of operation of the leading zone should basically be increased by 10%: K-CO = 10
In the case of an output value of the leading zone of 50%, the following corrected output value is calculated:
Adapted output value = 50% * (1 + (00.1 x 10)) = 55%

↗[P054] NoCO - Leading Zone

[P049] TRMP – Temperature Ramp

Data type	Word
Adjustment range interfaces/ multiplier	[0]...6553.5 / 10
Adjustment range BA	-99.9...[0]...99.9 Unit of the measurement input / minute

Characteristic behavior of the setpoint value at setpoint value changes.

[0.0]	In case of setpoint value jump with setpoint value increases and setpoint value decreases.
>0.0	In case of setpoint value increases, the setpoint value is ramped with the setting value to the final setpoint value, starting from the current actual value. Setpoint value jump with setpoint value decreases.
<0.0	In case of setpoint value increases and setpoint value decreases, the setpoint value is ramped with the setting value to the final setpoint value starting from the current actual value.

[P050] ARMP – Automatic Ramp

Data type	Bit
Adjustment range interfaces/ multiplier	[0], 1
Adjustment range BA	[off], on

[0]	[off]	In the case of the zone, the automatic ramp operation is deactivated.
1	on	In the case of the zone, the automatic ramp operation is activated.

All active zones assigned to a group (↗[P058] GPNo - Group Number) with a setpoint value greater than 0°C/32°F, with which the automatic ramping function is activated, are heated up at a setpoint value change > 30 °C automatically with respect to the actual value of the zone with the least rate of rise. The zone with the least rate of rise is called the reference zone.

With the aid of the function, mechanical stresses through large temperature gradient between zones of different rate of rise can be avoided.

In case of networking of several controllers over CAN, the function works with controller-overall effect.

- The automatic ramping function can also be employed in combination with the ↗[P035] IDEN - Heating Identification. With that, the uniform warming is implemented also in the case where the controller does not yet have any knowledge about the control zone and where this will be first calculated on the basis of the identification which progresses parallel to the automatic ramp.
- If the temperature difference of a zone to the reference zone is at least 30 Kelvin, or if no heating current is measured by a zone any longer, the zone is taken from the link of the automatic ramp after a time of 20 seconds.
- The automatic ramp requires one (at least once) executed identification Heating.

[SP26] GAP – Tolerance Band for Automatic Ramp

Data type	Byte
Adjustment range interfaces/ multiplier	0...[5]...25.5 Unit of measurement input / 10
Adjustment range BA	0...[5]...20

Unit of the measurement input

Stipulation of the tolerance band indicating how much the measured values of the zones may differ in automatic ramp operation. Zones which exceed the tolerance range are trimmed in the degree of operation.

[P037] TC-A – Manual Mode after Sensor Break

Data type	Bit
Adjustment range interfaces	[0], 1
Adjustment range BA	[off], on

Stipulates the characteristic behavior of the zone in the case of a sensor break.

[0]	[off]	Function is deactivated.
1	on	At sensor break it is automatically switch to manual mode. The output value is calculated dependent on the mean output value from the last cycles before sensor break.

Sensor break during heating-up can lead to overheating when automatic transfer of degree of operation, because in this phase the maximal degree of operation is output. A limitation for the degree of operation in manual mode can be set by parameter ↗[P025] OUT% – Maximum Degree of Operation in Manual Mode.

[P041] TCAL – Monitoring of Sensor SAL

Data type	Bit
Adjustment range interfaces	[0], 1
Adjustment range interfaces & BA	[off], on

Complex, dynamic monitoring function of the measuring element (sensor) per zone. The function helps to identify (as well as the static monitoring on sensor break and sensor incorrect polarity) to avoid additional error states in the area of the sensor and damage to the control zone e.g. through overheating.

An FAL alarm is output, when

- no identification is running
- at active heating current monitoring (AMPD <> 0, AMPN > 0, AMPT > 0)
- no current alarm is pending

Two causes can result in a SAL alarm:

- If the difference between current actual value and the last sampled actual value is
  ↗[P018] CT-H - Heating Sampling Time < 4 sec => 30K in 0.5 sec
  ↗[P018] CT-H - Heating Sampling Time >= 4 sec => 20K in 0.5 sec
  then a FAL alarm is immediately triggered after a pre-determined number of control cycles, since, with this actual value characteristic, it must involve a defect on the sensor line or on the sensor.
- If the temperature actual value does not increase by 4 K in standard operation in case of maximum degree of operation (↗[P023] OUTH – Heating Degree of Operation Damping) within a pre-determined time, then a FAL alarm is triggered.

  The response time of the sensor short-circuit monitoring

  - can be stipulated either manually (↗[P042] FALT - Sensor Short-Circuit Monitoring Time <> 0) or

  or

  - is derived automatically from the sampling time of the zone (↗[P042] FALT - Sensor Short-Circuit Monitoring Time = 0).

  Due to the response time, mistakenly triggered FAL alarms are reduced. The response time is started at the time when all prerequisites for a FAL alarm are satisfied. The response time is reset when one of the prerequisites for a FAL is not satisfied during the response time.

  According to the operating point, different FAL response times are worked with:

  - in the setpoint value band: FAL response time = 30 x heating sampling time
  - outside of the setpoint value band: FAL response time = 20 x heating sampling time
  - minimal response time (for CT-H < 15 seconds): FAL response time = 20 x 15 seconds

  The setpoint value band is derived directly from the ↗[P015] XP-H - Heating Proportional Band:

  SWB = XPH x 4

↗[P042] FALT - Sensor Short-Circuit Monitoring Time

[P042] FALT - Sensor Short-Circuit Monitoring Time

Data type	Word
Adjustment range interfaces/ multiplier	[0]...6553.6 seconds / 10
Adjustment range BA	[0]...999 seconds

[0]	Not active.

>0	Period after which a FAL alarm is output when the temperature actual value in standard operation at maximum degree of operation (↗[P023] OUTH – Heating Degree of Operation Damping) has not increased by 4 K. (↗[P041] TCAL – Monitoring of Sensor SAL and the stipulated FAL response times are without function)

9.5 Setpoint Value Functions

[P001] SP - Set Point

Data type	Integer
Adjustment range interfaces/ multiplier	[0.0]...6553.6 Unit of the measurement input / 10
Adjustment range BA	0...999

Unit of the measurement input

Main setpoint value on which control is implemented when 2., 3. or 4. setpoint value not active.

- With setpoint value 0°C/32°F, the zone is passivated. Only the current alarm at "switched off heating" continues to be monitored.
- With setpoint value 0°C/32°F, the control algorithm is reinitialized
- With active manual mode, the setpoint value is without function.

[P012] SP2 – 2. Setpoint / 2. Lowering/Reduction Value

Data type	Integer
Adjustment range interfaces/ multiplier	[0.0]...1999.9 Unit of the measurement input / 10
Adjustment range BA	[0]...999 Unit of the measurement input

The second setpoint value is employed either (a) directly as a setpoint value or (b) as a setpoint value in the program function.

(a) Directly as a setpoint value

The second setpoint value is activated

- over a digital input for all zones simultaneously
- over the data interfaces for every zone separately.

Over the parameters ↗[SP23] INP1 - Function Digital Input 1 and ↗[SP24] INP2 - Function Digital Input 2, it is stipulated, whether

- control is implemented on a second setpoint value or whether
- control is implemented on the ↗[P001] SP - Set Point reduced by the lowering value.

The reduction over digital input has a higher priority than the zone-specific software reduction.

b) As a setpoint value in the program function

The controller has a program function. With this, an arbitrary setpoint value profile can be realized with the four setpoint values.

If the program function should be used, then

- the ↗[P028] STMO - Startup Operation must be deactivated.
- the system parameter ↗[SP23] INP1 - Function Digital Input 1 is set adjusted to 8 or 9.

The program function is started by the negative signal edge at the digital input 2.

The following setpoint value profile will run:

- ↗[P012] SP2 – 2. Setpoint / 2. Lowering/Reduction Value with↗[P030] STT2 - Start-up Time of 2. Set Point/2. Lowering Value
- ↗[P013] SP3 – 3. Setpoint / 3. Lowering/Reduction Value with↗[P031] STT3 - Start-up Time of 3. Set Point/3. Lowering Value
- ↗[P014] SP4 – 4. Setpoint / 4. Lowering/Reduction Value with↗[P032] STT4 - Start-up Time of 4. Set Point/4. Lowering Value

The start-up time for the 2. setpoint value is not started until the actual values

- of all active zones
- whose setpoint value is not equal to 0°C

have reached the tolerance band around the second setpoint value. That is, the start-up time for the second setpoint value is not started until the "slowest" zone reaches the tolerance band around the second setpoint value.

It is to be ensured that the actual value can reach the tolerance band, because otherwise the program function will never be started.

[P013] SP3 – 3. Setpoint / 3. Lowering/Reduction Value

Data type	Integer
Adjustment range interfaces/ multiplier	[0.0]...1999.9 Unit of the measurement input / 10
Adjustment range BA	[0]...999 Unit of the measurement input

↗[P012] SP2 – 2. Setpoint / 2. Lowering/Reduction Value

[P014] SP4 – 4. Setpoint / 4. Lowering/Reduction Value

Data type	Integer
Adjustment range interfaces/ multiplier	[0.0]...1999.9 Unit of the measurement input / 10
Adjustment range BA	[0]...999 Unit of the measurement input

↗[P012] SP2 – 2. Setpoint / 2. Lowering/Reduction Value

[P026] SPLO – Lower Setpoint Value Limit

Data type	Integer
Adjustment range interfaces/ multiplier	[0.0]...1999.9 Unit of the measurement input / 10
Adjustment range BA	[0]...999 Unit of the measurement input

Lower input limitation for all temperature setpoints.

[P027] SPHI – Upper Setpoint Value Limit

Data type	Integer
Adjustment range interfaces/ multiplier	0.0...[500.0]...1999.9 Unit of measurement input / 10
Adjustment range BA	0...[500]...999 Unit of the measurement input

Upper input limitation for all temperature setpoints.
Exceeding the upper setpoint value limit an alarm is activated, when more than 5 seconds
`(Temperature actual value > SPHI + 5K)`

Output in manual mode: degree of operation -100%
Output in control mode: degree of operation -100%... 0%, depending on control status
The alarm resets, as long as not otherwise configured, when the actual temperature value falls below the limit value.
An alarm is suppressed, when
`SPHI < 150°C`

[P030] STT2 - Start-up Time of 2. Set Point/2. Lowering Value

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 minutes / 10
Adjustment range BA	[0]...99 minutes

The setting value 0 deactivates the start-up time of the second setpoint value and/or the second lowering value.

↗[P012] SP2 – 2. Setpoint / 2. Lowering/Reduction Value

[P031] STT3 - Start-up Time of 3. Set Point/3. Lowering Value

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 minutes / 1
Adjustment range BA	[0]...99 minutes

The setting value 0 deactivates the start-up time of the third setpoint value and/or the third lowering value.
↗[P030] STT2 - Start-up Time of 2. Set Point/2. Lowering Value
↗[P012] SP2 – 2. Setpoint / 2. Lowering/Reduction Value

[P032] STT4 - Start-up Time of 4. Set Point/4. Lowering Value

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 minutes / 1
Adjustment range BA	[0]...99 minutes

The setting value 0 deactivates the start-up time of the fourth setpoint value and/or the fourth lowering value.
↗[P030] STT2 - Start-up Time of 2. Set Point/2. Lowering Value
↗[P012] SP2 – 2. Setpoint / 2. Lowering/Reduction Value

9.6 Control characteristic

- The controller has two control parameter sets for heating and cooling. The second control parameter set is without function.
- The automatic calculation of the control parameters comes about through the so-called identification in case of setpoint value changes, above a pre-determined height. The calculation of the control parameters cooling is coupled with the calculation of the heating control parameters.

[P015] XP-H - Heating Proportional Band

Data type	Byte
Adjustment range interfaces/ multiplier	0.0...[9.9]...25.5% / 10
Adjustment range BA	0.0...[9.9]...25.5%

The P content changes the output of the PID controller proportional to the deviation between setpoint and actual value.

The proportional band is the range of the process variable, in which this linear reinforcement occurs before the output achieves its maximum or minimum. This range is indicated in percent of the measuring range. In order that the adjusted proportional band is independent of the sensor type and/or measuring range, the controller measuring range in case of PSG-controllers is assumed at 500°C (1% corresponds to 5 K).

The amplification of the controller decreases with increasing proportional band, and increases with decreasing proportional band. In case of a proportional band selected too small, the controller reacts to small deviations so severely that the control system oscillates. On the other hand, a proportional band which is selected too large makes the regulation very slow. The controller no longer reacts adequately to faults. In case of utilization of pure proportional band controllers in the control system, the deviation cannot be eliminated fully. There results the so-called permanent deviation.

[P016] TD-H - Heating Derivative Time

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[2]...255 seconds / 1

The differential content (D content) of the PID controller reacts in a leading way to the rate of change of the deviation or the actual value.

The differential content then supplies only a actuating variable, if the deviation or the actual value is changed. Therefore it cannot be used in order to stabilize a constant control deviation. That also explains the utilization of the D regulator only in association with P or PI characteristic.

The importance of the differential content in practice lies in the fact that the controller supplies actuating variables when the deviation first arises. The D characteristic makes the controller more rapid than a pure P or PI controller.

However, the D characteristic cannot distinguish between real deviations and so-called hum disturbances, i.e. higher frequency superpositions on the measurement variable. A differential content which is set adjusted too large reacts to the disturbances with fast changes of the actuating variable, through which the control system becomes very unsteady.

[P017] TI-H - Heating Integral Time

Data type	Word
Adjustment range interfaces/ multiplier	0...[9]...65536 seconds / 1
Adjustment range BA	0...[9]...999 seconds

With the integral content (I content) of the controller, a continuous change of the controller output value is achieved until the permanent deviation is stabilized to zero. With this, a permanent deviation is prevented.

The speed with which the stabilizing of the deviation happens and/or the influence of the I content on the actuating signal, is a function of the integral time (also: Integral time). A short integral time means a great influence of the I content on the setting value, i.e. it is integrated fast. A large integral time performs in reverse.

If the proportional band is changed, this also means a changed time-related characteristic with unchanged integral time.

The maximum of the ↗[P035] IDEN - Heating Identificationcalculated parameter value is 1275

[P018] CT-H - Heating Sampling Time

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 seconds / 1
Adjustment range BA	[0]...60 seconds

The sampling time defines a time period after which a ↗[P002] OPWR – Degree of Operation, which is recalculated from the control algorithm is output at the control output.

The sampling time is directly dependent on the dynamics of the controlled system and it is directly stipulated at the beginning of the ↗[P035] IDEN - Heating Identification

[P019] XP-C - Cooling Proportional Band

Data type	Byte
Adjustment range interfaces/ multiplier	0.0...[9.9]...25.5% / 10
Adjustment range BA	0.0...[9.9]...25.5%

↗[P015] XP-H - Heating Proportional Band

[P020] TD-C - Cooling Derivative Time

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[2]...255 seconds / 1

↗[P016] TD-H - Heating Derivative Time

[P021] TI-C - Cooling Integral Time

Data type	Word
Adjustment range interfaces/ multiplier	0...[9]...65535 seconds / 1
Adjustment range BA	0...[9]...999 seconds

↗[P017] TI-H - Heating Integral Time

[P022] CT-C - Cooling Sampling Time

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 seconds / 1
Adjustment range BA	[0]...60 seconds

↗[P018] CT-H - Heating Sampling Time

[P034] ONLC - Online Control

Data type	Bit
Adjustment range interfaces/ multiplier	0, [1]
Adjustment range BA	off, [on]

0	off	Without function.
[1]	[on]	After the calculation of the control parameters through the ↗[P035] IDEN - Heating Identification the characteristic behavior of the control zone is compared with the characteristic behavior of one controller-internal-filed model of the controlled system. In case of deviations of the characteristic behavior from real controlled system and the section model, the control parameters are corrected appropriately. The control parameters heating are not modifiable. They are overwritten immediately again through the control parameters calculated from the section model.

See ↗Table Overview Adaptation Methods of Control Parameters

[P035] IDEN - Heating Identification

Data type	Bit 1
Adjustment range interfaces/ multiplier	0, [1]
Adjustment range BA	off, [on]

In the identification phase the controller determines the mathematic model of a controlled system, which is saved in the controller. The control parameters are calculated. Settings of parameter see ↗Table Overview Adaptation Methods of Control Parameters

[P045] CFIX – Cooling Parameter fixed (Heating Identification)

Data type	Bit
Adjustment range interfaces/ multiplier	[0], 1
Adjustment range BA	[off], on

Specifies whether the Cooling control parameters are derived from the Heating control parameters after identification (only for 3-point zones).
Settings of parameter see ↗Table Overview Adaptation Methods of Control Parameters

Table Overview Adaptation Methods of Control Parameters

[P061] ALGO	Calculation of control parameter set Heating ↗[P035] IDEN - Heating Identification	[P061] ALGO	Calculation of control parameter set Cooling on identification Heating ↗[P045] CFIX – Cooling Parameter fixed (Heating Identification)
0 / **3** / **4** / **5** MAControl **)	**[P035] IDEN = on** Calculation of control parameters heating after a zone reset. i.e. ■ Controller is switched on ■ Status change of zone passive to zone active ■ Setpoint value <= 0°C / 0°F after first setpoint value increase with control deviation > 50K. Start of identification phase, in case of rise of actual value within 10 seconds < 0,4K (drift control). See *)	**0** / **3** / **4** MAControl **)	**[P045] CFIX = on** Control parameter set cooling are not modified by identification heating.
			[P045] CFIX = off Calculation of control parameter set cooling based on control parameters heating after end of identification phase heating.
	[P035] IDEN = off No calculation of control parameters heating in case of heating up. See *)		-

1 / **2** / **6** DYNControl**)	**[P035] IDEN = on** Calculation of control parameters heating after a zone reset. i.e. ■ Controller is switched on ■ Status change of zone passive to zone active ■ Setpoint value <= 0°C / 0°F after first setpoint value increase with control deviation > 50K. Start of identification phase, in case of rise of actual value within 10 seconds < 0.4K (drift control). See *)	**1** / **2** DYNControl**)	**[P045] CFIX = on** Control parameter set cooling are not modified by identification heating.
			[P045] CFIX = off Calculation of control parameter set cooling based on control parameters heating after end of identification phase heating.
	[P035] IDEN = off No calculation of control parameters heating in case of heating up. See *)		-

*) Online control ↗[P034] ONLC - Online Control monitors on base of the control parameter set heating essential changes on the structure of the control system and corrects if necessary the control parameter set heating.

**) Special see ↗[P061] ALGO – Algorithm

[P061] ALGO	Calculation of control parameter set Cooling after setpoint value change of -30K (independent of parameters)	Calculation of control parameter set Cooling after code number input
0 / **3** / **4** MAControl **)	On setpoint value change > -30K a cooling adaptation is started.	Independent of setting of CFIX the code numbers 111 and 112 control the cooling adaptation. Code number 111: Calculation of control parameter sets of all 3-point operation zones (COOL = on), with setpoint value > 0°C / 0°F. Code number 112: Calculation of control parameters of selected zones. Zone selection by setting of bit 0x80 in control byte of zones. Bit 0x08 in control byte is reset automatically. Start of cooling adaptation, in case of rise of actual value within 10 seconds <= +/-2K (drift control) and all actual values within tolerance band of 2K around setpoint value.
	On setpoint value change > -30K a cooling adaptation is started and the control parameter set cooling is calculated. Start of cooling adaptation, in case of rise of actual value within 10 seconds <= +/- 3,5K (drift control).	
	-	
1 / **2** DYNControl **)	-	Independent of setting of CFIX the code numbers 111 and 112 control the cooling adaptation. Code number 111: Calculation of control parameter sets of all 3-point operation zones (COOL = on), with setpoint value > 0°C / 0°F. Code number 112: Calculation of control parameters of selected zones. Zone selection by setting of bit 0x80 in control byte of zones. Bit 0x08 in control byte is reset automatically initiated by code number 112. Start of cooling adaptation, in case of rise of actual value within 10 seconds <= +/-2K (drift control) and all actual values within tolerance band of 2K around setpoint value.
	-	

**) Special see ↗[P061] ALGO – Algorithm

[P061] ALGO – Algorithm

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 /1
Adjustment range BA	[0]...6

Stipulates which algorithm is employed for the regulation of the zone.
Settings of parameter see ↗Table Overview Adaptation Methods of Control Parameters

ALGO = [0]	MAControl
	Suitable for all modes of actuating signal output (PWM/pulse cooling)

ALGO = 1	DYNControl. Control characteristic more dynamic than that of the MAControl.
	The calculation of the control parameters is implemented during the identification phase, up to reaching the setpoint value.

ALGO = 2	DYNControl.
	The calculation of the control parameters is implemented during the identification phase to 10 K prior to reaching the adjusted setpoint value.

ALGO = 3	MAControl for evaporate cooling with intelligent disturbance control ISK (see ↗[P070] PGH - Pulse Cooling)
	ISK includes: ■ Special degree of operation characteristics for static operation in the range of 0% around degree of operation ■ Algorithm for watching of operating point ■ „Stricter" control characteristics in tolerance band around setpoint value

ALGO = 4	MAControl for evaporate cooling with intelligent disturbance control ISK in alleviated form (see ↗[P070] PGH - Pulse Cooling)
	ISK includes: ■ Special degree of operation characteristics for static operation in the range of 0% around degree of operation ■ Algorithm for watching of operating point

ALGO = 5	MAControl for die bolts
	■ No mixed operation possible between die bolts - and standard control algorithm on one controller. In case of selection of die bolt control algorithm for at least one zone, then the die bolt control algorithm is employed with all the other zones. ■ Heating current monitoring not possible. ■ Degree of operation resolution 1%

ALGO = 6	DYNControl for die bolts
	Remaining operations as under adjustment for ALGO = 5.

[P062] XPH2 - Heating Proportional Band 2

Data type	Byte
Adjustment range interfaces/ multiplier	0.0...[9.9]...25.5% / 10
Adjustment range BA	0.0...[9.9]...25.5%

Without function

[P063] TDH2 – Heating Derivative Time 2

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[2]...255 seconds / 1

Without function

[P064] TIH2 – Heating Integral Time 2

Data type	Word
Adjustment range interfaces/ multiplier	0...[9]...65535 seconds / 1
Adjustment range BA	0...[9]...1275 seconds

Without function

[P065] CTH2 - Heating Sampling Time 2

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 seconds / 1
Adjustment range BA	[0]...60 seconds

Without function

[P066] XPC2 – Cooling Proportional Band 2

Data type	Byte
Adjustment range interfaces/ multiplier	0.0...[9.9]...25.5% / 10
Adjustment range BA	0.0...[9.9]...25.5%

Without function

[P067] TDC2 – Cooling Derivative Time 2

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[2]...255 seconds / 1

Without function

[P068] TIC2 – Cooling Integral Time 2

Data type	Word
Adjustment range interfaces/ multiplier	0...[9]...65535 seconds / 1
Adjustment range BA	0...[9]...1275 seconds

Without function

[P069] CTC2 – Cooling Sampling Time 2

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 seconds / 1
Adjustment range BA	[0]...60 seconds

Without function

[P070] PGH - Pulse Cooling

Data type	Bit
Adjustment range interfaces	[0], 1
Adjustment range BA	[off], on

Output method of the actuating signal at the cooling control output.
Prerequisite for the pulse cooling is that ↗[P038] COOL - 3-Point Operation is activated.

[0]	[off]	A PWM signal, proportional to the degree of operation, is output at the Cooling control output.
1	on	In case of the pulse cooling (also: impulse cooling), the pulse duration is constant at the Cooling control output and the pause duration (between 2 impulses) is variable. A pause of variable length follows on a constant pulse. The pause length is limited by the parameter ↗[P072] PMIN – Minimum Pause Duration and ↗[P073] PMAX – Maximum Pause Duration. The mandatory pause adjustable through the parameter ↗[P072] PMIN – Minimum Pause Duration and should prevent the transition from evaporating to continuous water flow. PMIN should correspond to a cooling pulse in about the reaction time of the route sections. Changes of the degree of operation are incorporated only on completion of the current pulse separation. The relationship between pulse width and maximum pause duration determines the real degree of operation resolution. For a one-percent degree of operation resolution ↗[P073] PMAX – Maximum Pause Duration at least the hundred-fold time value of ↗[P071] PULS – Pulse Duration is to be to set adjusted (please be sure to consider the different units of the parameters).

In case of activated pulse cooling the suitable control algorithm has to be stipulated for each zone (see ↗[P061] ALGO – Algorithm).

[P071] PULS – Pulse Duration

Data type	Word
Adjustment range interfaces & BA	4...[10]...500 (x10) ms

Defines the duration of an impulse at the control output Cooling in case of active ↗[P070] PGH - Pulse Cooling.

Be sure to consider that the pulse duration is 10x the setting value.

The setting value should

- be long enough so that the actuator (e.g. solenoid valve) can act properly
- be large enough to determine a change of the actual value

However, the setting value should be selected so that the actual value changes with an individual pulse only insignificantly.

In case of changes of the parameters of the pulse cooling, it is absolutely necessary that the control parameters be adapted to cooling.

↗[P070] PGH - Pulse Cooling

[P072] PMIN – Minimum Pause Duration

Data type	Word
Adjustment range interfaces/ multiplier	0.0...[5.0]...6553.5 seconds / 10
Adjustment range BA	0.0...[5.0]...99.9 seconds

Minimum duration between two pulses in case of active ↗[P070] PGH - Pulse Cooling

[P073] PMAX – Maximum Pause Duration

Data type	Word
Adjustment range interfaces/ multiplier	0.0...[20.0]...6553.5 / 10
Adjustment range BA	0.0...[20.0]...99.9 seconds

Maximum duration between two pulses in case of active ↗[P070] PGH - Pulse Cooling.

9.7 Alarm management

Every zone of the controller is monitored on the following alarm values:

- 4 Temperature limit value alarms
- Current alarm in case of "Heating On", i.e. monitoring of the measured current within a ↗[P010] AMPT - Current Tolerance by the ↗[P011] AMPN - Current Setpoint Value.
- Current alarm in case of "Heating Off", i.e. control as to whether a heating current is measured in the switched off status of the heating control output.
- Sensor break
- Sensor incorrect polarity
- Sensor short-circuit

The status of the zones can be output as collective alarm on the collective alarm outputs AL1, AL2 and AL3 or, in case of two-point zones, as zone-specific alarm on the cooling output .

[P004] AL 1 - Limit Value 1

Data type	Integer
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

Stipulation of the first temperature limit value.
Functioning method is stipulated in ↗[P008] ALD1 - Limit Value Definition 1.

[P005] AL 2 - Limit Value 2

Data type	Integer
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

Stipulation of the second temperature limit value.
Functioning method is stipulated in ↗[P008] ALD1 - Limit Value Definition 1.

[P006] AL 3 - Limit Value 3

Data type	Integer
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

Stipulation of the third temperature limit value.
Functioning method is stipulated in ↗[P009] ALD2 - Limit Value Definition 2.

[P007] AL 4 - Limit Value 4

Data type	Integer
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

Stipulation of the fourth temperature limit value.
Functioning method is stipulated in ↗[P009] ALD2 - Limit Value Definition 2.

[P008] ALD1 - Limit Value Definition 1

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

Stipulates the functioning method of the temperature limit values ↗[P004] AL 1 - Limit Value 1 and ↗[P005] AL 2 - Limit Value 2.

Combinations are possible as a setting value. The setting value results from the sum of the identifications.

With a setting value 7 (corresponds to the sum of the identifications 1, 2 and 4) the zone is checked for absolute ↗[P004] AL 1 - Limit Value 1. An alarm is output only in the case where the actual value has exceeded the temperature limit value once.
The setting value 0 defines the limit values 1 and 2 as relative limit value alarms.

Identifier	Limit value	Functioning method
1	Limit Value 1	Absolute temperature limit value (Otherwise: Relative temperature limit value).
2	Limit Value 1	Calculation only if limit value is reached.
4	Limit Value 1	Alarm when actual value > limit value (Otherwise: Alarm with actual value < limit value). Applies only for an absolute temperature limit value.
8	Limit Value 1	Without function.
16	Limit Value 2	Absolute temperature limit value (Otherwise: Relative temperature limit value).
32	Limit Value 2	Calculation only if limit value is reached.
64	Limit Value 2	Alarm when actual value > limit value (Otherwise: Alarm with actual value < limit value). Applies only for an absolute temperature limit value.
128	Limit Value 2	Without function.

[P009] ALD2 - Limit Value Definition 2

Data type Byte

Adjustment range interfaces & BA / multiplier [0]...255 / 1

Functioning method of the temperature limit values ↗[P006] AL 3 - Limit Value 3 and ↗[P007] AL 4 - Limit Value 4

Combinations are possible as a setting value. The setting value results from the sum of the identifications.

With a setting value 112 (corresponds to the sum of the identifications 16, 32 and 64) the zone is checked for absolute ↗[P007] AL 4 - Limit Value 4. An alarm is output only in the case where the actual value has exceeded the temperature limit value once.
The setting value 0 defines the limit values 3 and 4 as relative limit value alarms.

Identifier	Limit value	Functioning method
1	Limit Value 3	Absolute temperature limit value (Otherwise: Relative temperature limit value).
2	Limit Value 3	Calculation only if limit value is reached.
4	Limit Value 3	Alarm when actual value > limit value (Otherwise: Alarm with actual value < limit value). Applies only for an absolute temperature limit value.
8	Limit Value 3	Without function.
16	Limit Value 4	Absolute temperature limit value (Otherwise: Relative temperature limit value).
32	Limit Value 4	Calculation only if limit value is reached.
64	Limit Value 4	Alarm when actual value > limit value (Otherwise: Alarm with actual value < limit value). Applies only for an absolute temperature limit value.
128	Limit Value 4	Without function.

[P043] ALC1 - Cooling Alarm Output 1

Data type Byte

Adjustment range interfaces & BA / multiplier [0]...255 / 1

If the zone is configured as a two-point control zone (↗[P038] COOL - 3-Point Operation = off) the control output cooling can be used as an alarm output.
The functioning method of the alarm output is defined together with ↗[P044] ALC2 - Cooling Alarm Output 2

Combinations are possible as a setting value. The setting value results from the sum of the identifications.

With a setting value 112 (corresponds to the sum of the identifications 16, 32 and 64) the zone is checked for absolute ↗[P007] AL 4 - Limit Value 4. An alarm is output only in the case where the actual value has exceeded the temperature limit value once.
The setting value 0 defines the limit values 3 and 4 as relative limit value alarms.

Identifier	Alarm cause
1	Current fault in case of "Heating Off"
2	Current fault in case of "Heating On"
4	Limit Value 1
8	Limit Value 2
16	Limit Value 3
32	Limit Value 4
64	Sensor short-circuit
128	Sensor break/sensor incorrect polarity

[P044] ALC2 - Cooling Alarm Output 2

Data type Byte
Adjustment range interfaces & BA / multiplier [0]...255 / 1

Identifier	Alarm cause
1	Zone in identification phase
2	Actual value greater than maximum setpoint value/measuring range end value
4	Without function
8	Without function
16	Without function
32	Group interrupt alarm for entire control system
64	Group interrupt alarm for the zone block in which the zones are located
128	Alarm low active (Otherwise: Alarm high active)

↗[P043] ALC1 - Cooling Alarm Output 1

[P051] ALP1 - Alarm Calculation 1 with Passive Zones

Data type Byte
Adjustment range interfaces & BA / multiplier [0]...255 / 1

Basically, no alarm is calculated for a passive zone.
Nevertheless, if an alarm should be monitored in case of a passive zone, this can be stipulated with the aid of the parameters ↗[P051] ALP1 - Alarm Calculation 1 with Passive Zones and ↗[P052] ALP2 - Alarm Calculation 2 with Passive Zones.

Identifier	Alarm cause
1	Current fault in case of "Heating Off"
2	Current fault in case of "Heating On"
4	Limit Value 1

Identifier	Alarm cause
8	Limit Value 2
16	Limit Value 3
32	Limit Value 4
64	Sensor short-circuit
128	Sensor break/sensor incorrect polarity

↗[P052] ALP2 - Alarm Calculation 2 with Passive Zones

[P052] ALP2 - Alarm Calculation 2 with Passive Zones

Data type Byte

Adjustment range interfaces & BA / multiplier [0]...255 / 1

Identifier	Alarm cause
1	Without function
2	Actual value greater than maximum setpoint value/measuring range end value
4	Without function
8	Without function
16	Without function
32	Without function
64	Without function
128	Without function

↗[P051] ALP1 - Alarm Calculation 1 with Passive Zones

[SP08] A1D1 - Definition Byte 1 - Alarm Output 1

Data type Byte

Adjustment range interfaces & BA / multiplier [0]...255 / 1

Together with ↗[SP09] A1D2 - Definition Byte 2 - Alarm Output 1 and ↗[SP10] A1D3 - Definition Byte 3 - Alarm Output 1 the functioning method of the alarm output AL1 is defined.

Combinations are possible as a setting value. The setting value results from the sum of the identifications.

With a setting value A1D1 = 12 (corresponds to the sum of the identifications 4 and 8), A1D2 = 0 and A1D3 = 80 (corresponds to the sum of the identifications 64 and 16) an alarm is output on the alarm output AL1 if the temperature exceeds the limit value 1 and the limit value 2. The alarm signal is stored and can be reset-acknowledged.

Identifier	Alarm cause
1	Current fault in case of "Heating Off"
2	Current fault in case of "Heating On"
4	Limit Value 1
8	Limit Value 2
16	Limit Value 3
32	Limit Value 4
64	Sensor short-circuit
128	Sensor break/sensor incorrect polarity

[SP09] A1D2 - Definition Byte 2 - Alarm Output 1

Data type Byte

Adjustment range interfaces & BA / multiplier [0]...255 / 1

Identifier	Alarm cause
1	Zone in identification phase
2	Actual value greater than maximum setpoint value/measuring range end value
4	Without function
8	Without function
16	Without function
32	Without function
64	Without function
128	Without function

↗[SP08] A1D1 - Definition Byte 1 - Alarm Output 1

[SP10] A1D3 - Definition Byte 3 - Alarm Output 1

Data type Byte

Adjustment range interfaces & BA / multiplier [0]...255 / 1

Identifier	Alarm cause
1	Error CAN
2	Error PROFINET IO
4	CAN: Controller in the pre-operational mode
8	System error/channel data error (ERR)
16	Alarm status/alarm output storing
32	Alarm output low active (otherwise: Alarm output high active)
64	Alarm output resettable (in case of alarm status/alarm output storing): Alarm is not output before until danger signal is newly present.
128	Without function

↗[SP08] A1D1 - Definition Byte 1 - Alarm Output 1

[SP11] A2D1 - Definition Byte 1 - Alarm Output 2

Data type Byte

Adjustment range interfaces & BA / multiplier [0]...255 / 1

Stipulates the functioning method of the alarm output 2.
↗[SP08] A1D1 - Definition Byte 1 - Alarm Output 1

[SP12] A2D2 - Definition Byte 2 - Alarm Output 2

Data type Byte

Adjustment range interfaces & BA / multiplier [0]...255 / 1

Stipulates the functioning method of the alarm output 2.
↗[SP09] A1D2 - Definition Byte 2 - Alarm Output 1

[SP13] A2D3 - Definition Byte 3 - Alarm Output 2

Data type Byte

Adjustment range interfaces & BA / multiplier [0]...255 / 1

Stipulates the functioning method of the alarm output 2.
↗[SP10] A1D3 - Definition Byte 3 - Alarm Output 1

[SP14] A3D1 - Definition Byte 1 - Alarm Output 3

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

Stipulates the functioning method of the alarm output 3.
↗[SP08] A1D1 - Definition Byte 1 - Alarm Output 1

[SP15] A3D2 - Definition Byte 2 - Alarm Output 3

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

Stipulates the functioning method of the alarm output 3.
↗[SP09] A1D2 - Definition Byte 2 - Alarm Output 1

[SP16] A3D3 - Definition Byte 3 - Alarm Output 3

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

Stipulates the functioning method of the alarm output 3.
↗[SP10] A1D3 - Definition Byte 3 - Alarm Output 1

9.8 Heating Current Monitoring

A monitoring of the heating current enables the secure and early identification of the following faults:

- Insulation damage and/or partial failures of heaters
- Total loss of a heater of a group connected in parallel e.g. at the hot runner manifold or at the extrusion tool.
- Failures of individual control zones,
- For example, through defective heater, triggered protection interrupt or defective power circuit-breaker.
- Shorts on the power circuit-breakers (solid-state relay, TRIAC's, relay, contactor)

The measurement of the heating currents is implemented in a fixed time raster. The error messages are calculated after every measurement. For the avoidance of nuisance alarms through faulty measurements, the appropriate measurement is repeated with identification of a fault immediately and repeatedly before an alarm signal of the controller is output.

In this case the two following error types are distinguished between:

(a) Tolerance alarm (SAE-Alarm)

An alarm is output only if the measured current is located outside of the defined tolerance. This alarm is usually only evaluated as a prior warning.

(b) Current alarm with "switched off heating" (SAA-Alarm)

Short-circuits, "sticking" contactors and/or "alloyed" sound-state relays are causes for this alarm. Since, in this case, the heaters heat with full power, this alarm must be considered as a "critical alarm" which e.g. has as consequence a machine stop.

[P010] AMPT - Current Tolerance

Data type	Word
Adjustment range interfaces/ multiplier	0...[20]...6553.5% / 10
Adjustment range BA	0...[20]...100%

Stipulates a tolerance band around the ↗[P011] AMPN - Current Setpoint Value. A current alarm in case of "heating on", i.e. is a current tolerance alarm is output when a heating current is measured outside of the tolerance range

```
Current actual value < AMPT x (1 - (ATOL/100)) and
Current actual value > AMPT x (1 + (ATOL/100))
```

is measured.

In case of a current setpoint value of AMPN of 10 A and a current tolerance AMPT = 20, a current alarm in case of "heating on"/current tolerance alarm is output with the following current values:

- Current actual value < 10 A x (1 - (20/100)) = 8 A
- Current actual value > 10 A x (1 + (20/100)) = 12 A

[P011] AMPN - Current Setpoint Value

Data type	Integer
Adjustment range interfaces/ multiplier	[0.0]...6553.5 A / 10
Adjustment range BA	[0.0]...200.0 A

Comparative value for the heating current of the zone to be measured. The current setpoint value can be stipulated

- manually or

- be measured automatically by means of the current transfer function .

[Zone 046] AMPE - Current Range End Value

Data type	Word/10
Adjustment range interfaces/ multiplier	0...[100]...6553.5% / 10
Adjustment range BA	0...[100]...999%

Adaptation of the indicated current value to the measurement signal of the current transformer.
PSG standard current transformers provide a heating current proportional voltage of 42mVeff/A. This value matches the current range end value of 100%. In case of current transformers with other measured voltage, the indicated current value can be adapted.

Current transformer supplies 21 mVeff/A.
For adaptation of the display AMPE must be set to 200%.

For ↗[SP25] AMPD – Heating Current Measurement Method individual current measurement, the current range end value can be set individually for each zone.
For ↗[SP25] AMPD – Heating Current Measurement Method summation current measurement, the current range end value must be equal for all zones assigned to one and the same current transformer.

[P056] NoTR - Allocation Current Transformer

Data type	Byte

With individual current measurement without function (↗[SP25] AMPD – Heating Current Measurement Method= 1, 2 or 3).
With summation current measurement, the setting value stipulates the current measurement input to which the current transformer(s) for the corresponding zone is (are) connected. The setting value 0 means that no current transformer is planned for the zone.

[SP25] AMPD – Heating Current Measurement Method

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 / 1
Adjustment range BA	[0]...15

Stipulates the measurement method of the heating current measurement.

0	Deactivated current monitoring
1	Individual current measurement. ■ Degree of operation > 0%: Display of the last measured current value in case of switched-off heating ■ Degree of operation <= 0% display of the last measured current value in case of switched-off heating
2	Individual current measurement. Display of the currently measured heating current value in case of switched-on heating.
3	Individual current measurement. Display of the last measured current value in case of switched-off heating.
4	Summation current measurement. ■ Degree of operation > 0%: Display of the last measured current value in case of switched-off heating ■ Degree of operation <= 0% display of the last measured current value in case of switched-off heating
5	Summation current measurement. Display of the currently measured heating current value in case of switched-on heating
6	Summation current measurement. Display of the last measured current value in case of switched-off heating.
7	Without function.
8	Summation current measurement ■ Degree of operation > 0%: Display of the last measured current value in case of switched-off heating ■ Degree of operation <= 0% display of the last measured current value in case of switched-off heating. Measurement also at degree of operation = 0%.
9	Summation current measurement. Display of the currently measured heating current value in case of switched-on heating
10	Summation current measurement. Display of the last measured current value in case of switched-off heating.
11	Without function.
12	Summation current measurement ■ Degree of operation > 0%: Display of the last measured current value in case of switched-off heating ■ Degree of operation <= 0% display of the last measured current value in case of switched-off heating. In case of adjustment RELH = on.
13	Summation current measurement. Display of the currently measured heating current value in case of switched-on heating
14	Summation current measurement. Display of the last measured current value in case of switched-off heating.
15	Without function.

[SP34] AMPM - Maximum Current Value with Measurement Heater Off

Data type	Byte
Adjustment range interfaces/ multiplier	0.0...[0.5]...25.5 A / 10
Adjustment range BA	0.1...[0.5]...2.0 A

Stipulates the limit value, above which with a current measurement a current alarm is output in case of "Heating Off". The measurement is implemented with measurement of the heating currents.

[SP35] VOLT - Allocation of Voltage Module

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

With the SUW module (is measured accompanying the measurement of the heating currents the mains voltage). With this value the heating currents are adapted to a standardized voltage of 400 V independently of line voltage fluctuations.

Stipulates the current measurement input to which the SUW module is connected.

9.9 Group functions

Every zone can be assigned to a group. For this, 24 groups are available. With the assistance of the groups, for example, event-controlled functional chains can be formed.

The group functions have controller-overall effect, if the controllers are connected with each other over CAN-Bus.

The group function is storing.

- It is carried out after reset of the control system
- after deactivation of the Digital Input 2 if the system parameter ↗[SP23] INP1 - Function Digital Input 1= 0 or 1 is set adjusted.

[P058] GPNo - Group Number

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...24 / 1

Assigns the control zone to a group with the group number.

Setting value = 0 means that the zone is not assigned to any group.

[P059] GPF – Group Release by

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...24 / 1

Stipulates the group from which a release is given.

Setting value = 0 means that the zone does not require any release from another group, i.e. the zone starts immediately.

[P060] GPM – Group Mode

Data type	Byte
Adjustment range interfaces	[0]...255 / 1

Stipulates the condition whereby the release group issues a release or defines the function that is implemented for all zones of a group.

0	Release, if in case of all zones of the release group [Actual value > (Setpoint value - GW-)]
1	Release, if in case of all zones of the release group [Actual value > LVA1]
2	Release, if in case of all zones of the release group [Actual value > LVA2]
3	Release, if in case of all zones of the release group [Actual value > LVA3]
4	Release, if in case of all zones of the release group [Actual value > LVA4]
5	A setpoint value of a group received over an interface is sent to all other zones.
10	As 0. After zone reset zone is heated up from the sloping setpoint value assuming.
11	As 1. After controller reset, zone is heated up starting from the sloping setpoint value.
12	As 2. After controller reset, zone is heated up starting from the sloping setpoint value.
13	As 3. After controller reset, zone is heated up starting from the sloping setpoint value.
14	As 4. After controller reset, zone is heated up starting from the sloping setpoint value.

[SP39] LVA1 – Release Limit Value 1

Data type	Integer
Adjustment range interfaces/ multiplier	[0]...6553.5 Unit of the measurement input / 10
Adjustment range BA	[0]...999 Unit of the measurement input

Release limit value for the release group.

[SP40] LVA2 – Release Limit Value 2

Data type	Integer
Adjustment range interfaces/ multiplier	[0]...6553.5 Unit of the measurement input / 10
Adjustment range BA	[0]...999 Unit of the measurement input

Release limit value for the release group.

[SP41] LVA3 – Release Limit Value 3

Data type	Integer
Adjustment range interfaces/ multiplier	[0]...6553.5 Unit of the measurement input / 10
Adjustment range BA	[0]...999 Unit of the measurement input

Release limit value for the release group.

[SP42] LVA4 – Release Limit Value 4

Data type	Integer
Adjustment range interfaces/ multiplier	[0]...6553.5 Unit of the measurement input / 10
Adjustment range BA	[0]...999 Unit of the measurement input

Release limit value for the release group.

9.10 CAN-BUS

The description of the communication protocols, as well as the specification of the configuration parameters, is to be taken from the protocol descriptions and the parameter-/object lists.

[SP05] CADR - CANopen Base Address

Data type	Char
Adjustment range interfaces & BA	0...[32]...127 / 1

CAN-Bus address of the controller = CADR + Device ID
↗Addressing and Further Functions by DIP Switch

[SP06] A-OP - Auto Operational Modus CANopen

Data type	Bit
Adjustment range interfaces	0, [1]
Adjustment range BA	off, [on]

0	off	The components on the CAN-Bus are provided with the "Auto-operational" command from a CANopen Master.
[1]	[on]	The controller, as well as that relevant CAN peripheral components, are functional in CAN-open operation, also without CAN-open masters. For this, the controller sends the "Auto-operational Mode On" command.

[SP45] CANT - Timeout CAN (Zone off)

Data type	Byte
Adjustment range interfaces/ multiplier	[0]...255 seconds / 1
Adjustment range BA	[0]...120 seconds

Specifies the time within which communication over the CAN-Bus must occur. If no communication is determined, no actuating signal is output to the control outputs.
Setting value = 0 deactivates the function.

9.11 Ethernet

The description of the communication protocols, as well as the specification of the configuration parameters, is to be taken from the protocol descriptions and the parameter-/object lists.

[SP46) IP1 - IP Address of 1. Octet

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[192]...255 / 1

First octet of the Device IP (**XXX**.***.***.***)

[SP47] IP2 - IP Address of 2. Octet

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[168]...255 / 1

Second octet of the Device IP (***.**XXX**.***.***)

[SP48] IP3 - IP Address of 3. Octet

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[0]...255 / 1

Third octet of the Device IP (***.***.**XXX**.***)

[SP49] IP4 - IP Address of 4. Octet

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[200]...255 / 1

Base IP of the fourth octet of the Device IP.

```
IP of the controller = IP1.IP2.IP3.IP4+Device-ID
```

↗Addressing and Further Functions by DIP Switch

[SP50] SUB1 - Subnet mask of 1. Octet

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[255] / 1

First octet of the Device Subnet mask (**XXX**.***.***.***)

[SP51] SUB2 - Subnet mask of 2. Octet

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[255] / 1

Second octet of the Device Subnet mask (***.**XXX**.***.***)

[SP52] SUB3 - Subnet mask of 3. Octet

Data type	Byte
Adjustment range interfaces & BA / multiplier	0...[255] / 1

Third octet of the Device Subnet mask (***.***.**XXX**.***)

[SP53] SUB4 - Subnet mask of 4. Octet

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

Fourth octet of the Device Subnet mask (***.***.***.**XXX**).

9.11.1 Change IP setting

Start project setup and configuration tool and create a project with a PNIO-controller.

Set DIP switch 1...5 to ON in register Info > Communication. Do the same setting for the controller. Independent from the existing IP in the controller, the standard IP 192.168.0.200 is used now. For the communication with the controller, the network settings, the IP, of the PC, where project setup and configuration tool is running, has to be adjusted to the address range (fix IP address 192.168.0.*, subnet mask 255.255.255.0).

Set the desired IP in the system parameters ↗[SP46) IP1 - IP Address of 1. Octet to ↗[SP49] IP4 - IP Address of 4. Octet. Write the data to the controller.

Set DIP switch in register Info > Communication and on the controller as desired. Now the IP set under SP46 to SP49 is used for communication dependent on the DIP switch setting.

9.12 Gateway

Instead of converting protocols, the default gateway in an IP configuration does route not subnet relevant network requests to another subnet and fulfills therewith the function of a router.

[SP61] GWY1 - Gateway 1

Data type	Unsigned Char
Adjustment range interfaces	0...[192]...255
Unit	n.a.

First octet of the gateway address (**XXX**.***.***.***)

[SP62] GWY2 - Gateway 2

Data type	Unsigned Char
Adjustment range interfaces	0...[168]...255
Unit	n.a.

Second octet of the gateway address (***.**XXX**.***.***)

[SP63] GWY3 - Gateway 3

Data type	Unsigned Char
Adjustment range interfaces	[0]...255
Unit	n.a.

Third octet of the gateway address (***.***.**XXX**.***)

[SP64] GWY4 - Gateway 4

Data type	Unsigned Char
Adjustment range interfaces	0...[1]...255
Unit	n.a.

Fourth octet of the gateway address (***.***.***.**XXX**)

9.13 Representation of operating/visual display units BA

[SP17] DISP - Display in Case of Passivated Zone (BA)

Data type	Bit
Adjustment range interfaces	[0], 1
Adjustment range BA	[off], on

[0]	[off]	The zone displays of passivated zones are faded out.
1	on	The zone displays are represented also in case of passivated zones.

[SP27] DIS% - Display in Manual Mode (BA)

Data type	Bit
Adjustment range interfaces	[0], 1
Adjustment range BA	[off], on

If manual mode activates...

[0]	Actu-al	Display of the actual values in the zone displays.
1	StL	Display of the setting levels in the zone displays.

[SP36] LANG - Language

Data type	Byte
Adjustment range interfaces/ multiplier	[0], 1 / 1
Adjustment range BA	[off], on

Display of the short codes in the information display, as well as that status/error report in the zone displays in ...

[0]	German
1	English

9.14 Other parameters

[P036] APPL - Application

Data type	Byte
Adjustment range interfaces & BA / multiplier	[0]...255 / 1

By means of the applications parameter, extended customer-specific functions or adaptations to pre-determined applications can be connected to the standard functions.

0	Interruption of the identification phase 30 minutes	For zones without heating current monitoring. Interrupt criterion for identification algorithm, if e.g. power setting unit is disconnected, through which no temperature rise is implemented and faulty control system parameters were calculated.

1	Interruption of the identification phase 4 minutes	See setting value 0
2	Interruption of the identification phase 30 minutes	See setting value 0
3	Customer-specific function	
4	Hot air	Regulation optimizes configured for hot air application.
5	Minimum current measured value 0.1 A	
6	Without function	
7	Customer-specific function	
8	Without function	
9	Customer-specific function	
10	Customer-specific function	
11	Customer-specific function	

By the Bit 7 of parameter APPL/APPL the scaling of the actual values (standard signal input U/I direct on controller, and/or external by CAN) is managed (↗[P047] RG L - Lower Temperature Value at Standard Signal Inputs, ↗[P048] RG H - Upper Temperature Value with Standard Signal Inputs).

9.15 Tabular overview

9.15.1 Parameters

↗[P001] SP - Set Point
↗[P002] OPWR – Degree of Operation
↗[P003] MANU – Manual Mode
↗[P004] AL 1 - Limit Value 1
↗[P005] AL 2 - Limit Value 2
↗[P006] AL 3 - Limit Value 3
↗[P007] AL 4 - Limit Value 4
↗[P008] ALD1 - Limit Value Definition 1
↗[P009] ALD2 - Limit Value Definition 2
↗[P010] AMPT - Current Tolerance
↗[P011] AMPN - Current Setpoint Value
↗[P012] SP2 – 2. Setpoint / 2. Lowering/Reduction Value
↗[P013] SP3 – 3. Setpoint / 3. Lowering/Reduction Value
↗[P014] SP4 – 4. Setpoint / 4. Lowering/Reduction Value
↗[P015] XP-H - Heating Proportional Band
↗[P016] TD-H - Heating Derivative Time
↗[P017] TI-H - Heating Integral Time
↗[P018] CT-H - Heating Sampling Time
↗[P019] XP-C - Cooling Proportional Band
↗[P020] TD-C - Cooling Derivative Time
↗[P021] TI-C - Cooling Integral Time
↗[P022] CT-C - Cooling Sampling Time
↗[P023] OUTH – Heating Degree of Operation Damping
↗[P024] OUTC – Cooling Degree of Operation Damping
↗[P025] OUT% – Maximum Degree of Operation in Manual Mode
↗[P026] SPLO – Lower Setpoint Value Limit
↗[P027] SPHI – Upper Setpoint Value Limit
↗[P028] STMO - Startup Operation
↗[P029] STT - Startup Operation Initiation Time
↗[P030] STT2 - Start-up Time of 2. Set Point/2. Lowering Value
↗[P031] STT3 - Start-up Time of 3. Set Point/3. Lowering Value
↗[P032] STT4 - Start-up Time of 4. Set Point/4. Lowering Value
↗[P033] OFFS - Temperature Offset
↗[P034] ONLC - Online Control
↗[P035] IDEN - Heating Identification
↗[P036] APPL - Application
↗[P037] TC-A – Manual Mode after Sensor Break
↗[P038] COOL - 3-Point Operation
↗[P039] RELH – Heating Relay Output
↗[P040] RELC – Cooling Relay Output
↗[P041] TCAL – Monitoring of Sensor SAL
↗[P042] FALT - Sensor Short-Circuit Monitoring Time

↗[P043] ALC1 - Cooling Alarm Output 1
↗[P044] ALC2 - Cooling Alarm Output 2
↗[P045] CFIX – Cooling Parameter fixed (Heating Identification)
↗[Zone 046] AMPE - Current Range End Value
↗[P047] RG L - Lower Temperature Value at Standard Signal Inputs
↗[P048] RG H - Upper Temperature Value with Standard Signal Inputs
↗[P049] TRMP – Temperature Ramp
↗[P050] ARMP – Automatic Ramp
↗[P051] ALP1 - Alarm Calculation 1 with Passive Zones
↗[P052] ALP2 - Alarm Calculation 2 with Passive Zones
↗[P053] K-CO – Amplification Factor for Zone in Leading Mode
↗[P054] NoCO - Leading Zone
↗[P055] ZONE – Zone
↗[P056] NoTR - Allocation Current Transformer
↗[P057] NoZN - Zone Allocation to Measurement Input on Sensor Interface FIN
↗[P058] GPNo - Group Number
↗[P059] GPF – Group Release by
↗[P060] GPM – Group Mode
↗[P061] ALGO – Algorithm
↗[P062] XPH2 - Heating Proportional Band 2
↗[P063] TDH2 – Heating Derivative Time 2
↗[P064] TIH2 – Heating Integral Time 2
↗[P065] CTH2 - Heating Sampling Time 2
↗[P066] XPC2 – Cooling Proportional Band 2
↗[P067] TDC2 – Cooling Derivative Time 2
↗[P068] TIC2 – Cooling Integral Time 2
↗[P069] CTC2 – Cooling Sampling Time 2
↗[P070] PGH - Pulse Cooling
↗[P071] PULS – Pulse Duration
↗[P072] PMIN – Minimum Pause Duration
↗[P073] PMAX – Maximum Pause Duration

9.15.2 System- and communication parameters

[SP01]-[SP04] n.a.
↗[SP05] CADR - CANopen Base Address
↗[SP06] A-OP - Auto Operational Modus CANopen
[SP07] n.a.
↗[SP08] A1D1 - Definition Byte 1 - Alarm Output 1
↗[SP09] A1D2 - Definition Byte 2 - Alarm Output 1
↗[SP10] A1D3 - Definition Byte 3 - Alarm Output 1
↗[SP11] A2D1 - Definition Byte 1 - Alarm Output 2
↗[SP12] A2D2 - Definition Byte 2 - Alarm Output 2
↗[SP13] A2D3 - Definition Byte 3 - Alarm Output 2
↗[SP14] A3D1 - Definition Byte 1 - Alarm Output 3
↗[SP15] A3D2 - Definition Byte 2 - Alarm Output 3
↗[SP16] A3D3 - Definition Byte 3 - Alarm Output 3
↗[SP17] DISP - Display in Case of Passivated Zone (BA)
↗[SP18] SEN1 - Sensor type Zone 1...8
↗[SP19] SEN2 - Sensor type Zone 9...16
↗[SP20] SEN3 - Sensor type Zone 17...24
↗[SP21] SEN4 - Sensor type Zone 25...32
↗[SP22] CELS – Temperature Unit °C/°F
↗[SP23] INP1 - Function Digital Input 1
↗[SP24] INP2 - Function Digital Input 2
↗[SP25] AMPD – Heating Current Measurement Method
↗[SP26] GAP – Tolerance Band for Automatic Ramp
↗[SP27] DIS% - Display in Manual Mode (BA)
↗[SP28] OFF1 - Offset Zone 1...8
↗[SP29] OFF2 - Offset Zone 9...16
↗[SP30] OFF3 - Offset Zone 17...24
↗[SP31] OFF4 - Offset Zone 25...32
[SP32]-[SP33] n.a.
↗[SP34] AMPM - Maximum Current Value with Measurement Heater Off
↗[SP35] VOLT - Allocation of Voltage Module
↗[SP36] LANG - Language
SP37] n.a.
↗[SP38] MAXK – Maximum Number of Channels
↗[SP39] LVA1 – Release Limit Value 1
↗[SP40] LVA2 – Release Limit Value 2
↗[SP41] LVA3 – Release Limit Value 3
↗[SP42] LVA4 – Release Limit Value 4
[SP43]-[SP44] n.a.
↗[SP45] CANT - Timeout CAN (Zone off)
↗[SP46) IP1 - IP Address of 1. Octet
↗[SP47] IP2 - IP Address of 2. Octet
↗[SP48] IP3 - IP Address of 3. Octet

↗[SP49] IP4 - IP Address of 4. Octet
↗[SP50] SUB1 - Subnet mask of 1. Octet
↗[SP51] SUB2 - Subnet mask of 2. Octet
↗[SP52] SUB3 - Subnet mask of 3. Octet
↗[SP53] SUB4 - Subnet mask of 4. Octet
[SP54]-[SP60] n.a.
↗[SP61] GWY1 - Gateway 1
↗[SP62] GWY2 - Gateway 2
↗[SP63] GWY3 - Gateway 3
↗[SP64] GWY4 - Gateway 4

10 Code numbers

Behind code numbers are complex system-specific or process-specific functions, which simplify the handling of certain functions with the controller or which repair exception states in which the controller finds itself e.g. after faults or alarms.

Code numbers can be activated over all interfaces (see corresponding protocol descriptions) and the operating and visual display units.

DEC	HEX	Function	Information on the function
010	00A	Load setpoint value set 1 from EEPROM	
101	00B	Load setpoint value set 2 from EEPROM	
012	00C	Load setpoint value set 3 from EEPROM	
013	00D	Load setpoint value set 4 from EEPROM	
020	014	Save setpoint value set 1 to EEPROM	
021	015	Save setpoint value set 2 to EEPROM	
022	016	Save setpoint value set 3 to EEPROM	
023	017	Save setpoint value set 4 to EEPROM	
030	01E	Switch to °C	
031	01F	Switch to °F	
034	022	Initialization of CANopen default parameters	
040	028	Resetting the temperature ramp	
041	029	Manual activation of a current measurement	↗Manual Activation of a Current Measurement (Code Number 41)
050	032	Activate control outputs at controller start (only if adjustment PROT=HRS)	
111	06F	Start automatic cooling adaptation	
112	070	Start zone-wise cooling adaptation	For all zones, that should be adapted, set bit 0x08 in control byte for zone by interface. Code number 112 activates the cooling adaptation for the selected zones and resets bit.
177	0B1	Activate current transfer	Current setpoint value = Measured heating current
200	0C8	Lock operations by BA panel	Operating and display unit function
201	0C9	Unlock operations by BA panel	Operating and display unit function
202	0CA	Set CAN-Bus default values	
400	190	Take over of power-on configuration	
440	1B8	Reset/acknowledge alarm status/ alarm outputs	
441	1B9	Reset-acknowledge alarm status/ alarm output 1	
442	1BA	Reset-acknowledge alarm status/ alarm output 2	
443	1BB	Reset-acknowledge alarm status/ alarm output 3	
501	1F5	Reset-acknowledge software reduction	
502	1F6	Block group release	↗Group functions
600	258	Start diagnostic function for *allocation sensor/heating*	↗Diagnostic function (code number 600) - Allocation of Sensor and Heating
601	259	Start *heating current* diagnostic function	↗Diagnostic function (Code Number 601) - Start Current Measurement
602	25A	Reset-acknowledge diagnostic function and delete alarms	

DEC	HEX	Function	Information on the function
759	2F7	Load ex-works delivery status	
800	320	Reset trimming and all offset values	
801	321	Trimming of all zones according to zone 1	
802	322	Trimming of zone 1 to 100°C	
985	3D9	Standard CPU matching	
999	3E7	Reset control system	
	Available code number; not in list of value of flexotempMANAGER		

11 Firmware update

We continuously further develop and improve our products and make available online updates for

- Project Setup and Configuration Tool flexotempMANAGER
- corresponding operating manuals
- controller software in HEX-Files
- Data sheets for components

in the Internet.

flexotempMANAGER can be configured to download updates automatically or to wait for manual user input.

The controller is update-capable with the aid of the project setup and configuration tool flexotempMANAGER over the Ethernet interface and can be maintained at the latest software status after purchase. The controller firmware is available in file form ("HEX file").

The project setup and configuration tool flexotempMANAGER as well as the controller firmware are available on the homepage www.psg-online.de.

Procedure at firmware update

- Project Setup and Configuration Tool flexotempMANAGER must be installed on PC.
- See operation instructions flexotempMANAGER operation chapter context menu for master components - interfaces test
  Ensure, that the connection between PC and controller works.
- See operation instructions flexotempMANAGER operation chapter context menu for master components - firmware update

12 Appendix

12.1 Version History

Version	Date	Changes
1.00.01	8/28/2015	In detail, the following amendments/corrections were made: ■ DIP 1-7; DIP1-8 at ETR132PNIO
...	...	...
1.00.00	2/28/2014	First publication. Valid from controller software version ETR132800514A PSG Plastic Service GmbH Pirnaer Straße 12-16 68309 Mannheim Germany Tel. +49 621 7162 0 Fax +49 621 7162 162 www.psg-online.de info@psg-online.de